Sustainability and Master Planned Estates: from principles to practice

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Abstract

This research is motivated by the need to create urban environments that cater to population growth and provide quality of life in ways that limit the detrimental impacts of urban development. The research consists of a review, analysis and critique of attempts to implement sustainability principles through the use of performance assessment tools in the delivery of master planned estates (MPEs) in Australia. At the core of the inquiry is a systematic analysis of sustainability assessment and decision-making tools currently utilised in the MPE development sector, as such tools are primary vehicles for attempting to move sustainability from theory into practice.

The research draws on case study methodology and evaluation studies to develop an analytical framework derived from a critical review of literature on sustainability, sustainability assessment and MPEs. The application of the framework to selected cases studies of existing sustainability assessment tools targeted as MPE development reveals the strengths and weaknesses of tools in terms of their response to sustainability theory, implementation of sustainability assessment methodology, and effectiveness as mechanisms for operationalising sustainability principles in the planning and delivery of MPEs.

The thesis reveals a limited but growing engagement with sustainability in MPE development, and a corresponding emergence of sustainability assessment tools targeted at this scale of development. However, there is little critical interrogation of the integrity and effectiveness of such tools. This thesis shows that current sustainability assessment tools acting in this space are lacking in rigour, transparency and independent verification. They are being utilised by a small subsection of developers who selectively apply assessment to targeted projects. Existing tools thus provide limited opportunity to have a significant impact on sustainability performance across the MPE development sector.

Building on the analysis of existing tools, the thesis proposes guiding principles for the future development and use of assessment tools to more successfully operationalise

sustainability in the delivery of MPEs. In examining the implications of the analysis of tools for existing urban policy frameworks, the thesis argues that effective sustainability assessment of MPE development requires an increased role for government to either develop standards to ensure the integrity of industry and independent tools and integration with development approval processes, or to develop its own mechanisms for sustainability assessment in development approval.

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Abbreviations

AHURI	Australian Housing and Urban Research Institute
BEQUEST	Building Environmental Quality Evaluation for Sustainability through Time
BREEAM	BRE Environmental Assessment Method
EFA	Ecological Footprint Analysis
EIA	Environmental Impact Assessment
GBCA	Green Building council of Australia
GHG	Greenhouse Gas
LEED	Leadership in Energy and Environmental Design
LEED-ND	LEED Neighborhood Development
LMC	Land Management Corporation
MPC	Master Planned Community
MPCT	Master Planned Community Tool
MPE	Master Planned Estate
NABERS	the National Australian Built Environment Rating System
NSAM	National Sustainability Assessment Methodology
OECD	Organisation for Economic Co-operation and Development
PPDS	Precinct Planning and Design Standard
SEA	Strategic Environmental Assessment
TBL	Triple Bottom Line
TDR	Tradable Development Rights
TRS	Traditional Regulatory Subdivision
UDIA	Urban Development Industry Association
UNCED	United Nations Conference on Environment and Development
USGBC	United States Green Building Council
WSUD	Water Sensitive Urban Design

Statement of Authorship

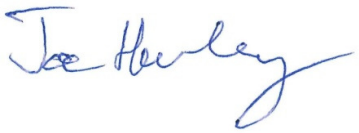
I, Joe Hurley, declare that:

a) except where due acknowledgement has been made, this work is that of myself alone;

b) this work has not been submitted previously, in whole or part, to qualify for any other academic award;

c) the content of the thesis is the result of work that has been carried out since the official commencement date of the approved research program;

d) any editorial work, paid or unpaid, carried out by a third party is acknowledged.

Signed:  Date: 11th of April 2011

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Finally I would like to thank my family and friends for their love and support, in particular my wife Camilla, whose emotional, practical and intellectual support made this thesis possible.

This thesis has been professionally proof read by Julie Banfield. I take full responsibility for any mistakes that exist.

For Camilla and Harriet

Chapter 1: Introduction

1.1 Background to the Research

When work began on this research project in 2005, VicUrban, the Victorian Government's land development agency, had just commenced construction on a new urban fringe development called Aurora[1]. Aurora was to be their new "flagship sustainable housing development" (VicUrban 2007:1). Concurrently, VicUrban was working on the in-house development of a mechanism for defining and measuring their sustainability initiatives, which would become known as the VicUrban Sustainability Charter. Promotional material around the Aurora development, as well as the Charter itself, espoused principles of sustainability and actively adopted the language of sustainable development. In this regard, VicUrban were somewhat of a pioneer in the Australian commercial urban development sector. But VicUrban's initiatives prompted a number of questions around the validity of such claims to sustainability in urban development and the efficacy of tools developed to achieve that end. What, in fact, does sustainability mean in the context of urban development? And how can it be achieved? Was VicUrban's Charter – and other similar tools – achieving its goals of operationalising sustainability in our cities' growth areas? If so, how? And if not, why not?

Five years on Aurora has its first residents, with a population of 1,500 of a planned 25,000 (VicUrban 2007; Weymes 2011). The VicUrban Charter has led to the creation of Sustainable Community Rating – a suite of tools based on the Charter (SCR 2011) as part of a process aimed at broadening the use of the tools in the development industry (SCR 2011). More recently, VicUrban has partnered with the Green Building Council of Australia (GBCA) and other organisations in an effort to achieve wider relevance for the tools (GBCA 2009). There are a number of other sustainability assessment tools developed in Australia, however their use is limited, and as such are having a limited impact on the housing market. Increasingly the relevance of international tools is being

[1] VicUrban was an industry partner on the Australian Research Council Linkage grant that funded this research project.

considered in an Australian context (Fyfe et al. 2008). The current state of play, then, is a fragmented and marginalised engagement with sustainability assessment in the context of master planned estates (MPEs), with little critical examination of tools acting in this space.

In this thesis I provide a critical examination of attempts to operationalise sustainability at an estate level through the use of sustainability assessment tools. I consider the VicUrban developed tools, along with several others, and subject them to rigorous interrogation. I present findings on the utility and effectiveness of these particular tools, and propose guiding principles for the future development and use of assessment tools to more successfully operationalise sustainability and achieve significant improvement in the performance of MPEs.

Sustainability and cities

The relationship between human activity and ecological systems is now the subject of an active debate, informed by extensive research. There is considerable scientific consensus regarding the impacts of human resource use and waste emissions on ecological systems. There is also widespread public and political awareness. While policy responses are mixed, there exists a general acknowledgement that substantive policy attention must be paid to protect the viability of ecological systems and the services they provide to humanity. This is manifest in policy debates on water scarcity, energy security and climate change.

This research is founded on an ecological world view – that our fundamental dependence on ecological systems requires us to maintain these systems and operate within their limits (Wackernagel and Rees 1996; Krebs 2008). It acknowledges the significant environmental challenges that societies around the world now face. On a global scale this is dominated by the effect of greenhouse gas (GHG) emissions on climatic systems, and the ensuing impacts on the ecological systems that we depend on for food, water, clean air, and renewable resources. A multitude of location-specific issues caused by human habitation are also affecting the viability of ecological systems, with anthropogenic resource consumption and waste production causing environmental

degradation and biodiversity depletion. These localised effects contribute to regional and global issues of resource scarcity as a result of overuse of renewable resources and the exhaustion of stocks of non-renewable resources. This is most evident in the dwindling supplies of fossil-fuel-based resources upon which our societies are so dependent for energy and transport. Also of particular concern in Australia is the availability of appropriate supplies of water to sustain both human populations and ecological systems. It is telling that several major Australian cities are now opting for the development of expensive and energy-intensive augmentation solutions, such as desalination and recycling, to continue to meet demand, rather than attempting to significantly reduce consumption. To date, political responses to water scarcity illustrate the entrenched social norms that inform and legitimise our patterns of resource consumption (Hurley and Mercer 2008). It is an ontological assumption of this research that increasing population and increasing resource use is problematic and that the ways in which we currently respond to the natural world in order to meet our needs is unsustainable. As such, change is needed in both physical infrastructure and social behaviours, to reduce environmental degradation and improve equity and quality of life for current and future generations.

Cities are the dominant form of settlement and it is accepted in this research that cities are at the centre of human futures. The majority of the world's population now live in cities (UNFPA 2009), and this trend toward urbanisation is increasing at a rapid pace. As such, cities are centres of appropriation of the Earth's resources and biological capacity. They are sites of highly concentrated resource consumption and waste production, exacerbated by increasing levels of household and personal consumption (Rees and Wackernagel 1996; ABS 2007a; 2007b).

As urban populations expand, so too does the physical footprint of the city, as a significant proportion of population growth, particularly in North American and Australian cities, tends to be catered for by expanding development on the fringes of cities (Buxton and Scheurer 2005a; Knaap et al. 2007). Since most cities are located in fertile regions – a legacy of decisions to establish human settlements in areas most conducive to sustaining concentrated populations (Kostoff 1991) – the contemporary

expansion of cities translates directly to increased consumption of bio-diverse and bio-productive land (Ortiz 2002; Hansen et al. 2005). This physical expansion also increases the need for extended travel within cities, as residential areas are located further and further away from centres of industry and commerce (Newman and Kenworthy 1999). In Australia, in particular, this increased mobility has resulted in a high reliance on private vehicle use, since city fringe developments are generally poorly served by public forms of transport (Newman and Kenworthy 1999). This, of course, further exacerbates oil dependency, fossil fuel consumption and associated GHG emissions and effects on climate change.

A further trend of concern in Australian cities is the increasing spatial dimension of social division. Several recent studies have revealed the trend toward inner and middle regions of cities being occupied by more advantaged populations, and outer regions serving the less advantaged (Dodson and Sipe 2006; 2008; ABS 2008; Baum and Gleeson 2010). Typically, it is the inner and middle suburbs that have greater access to employment, services, and transport options, while outer suburbs are characterised by a greater dependency on the motor car for mobility and a scarcity of local employment and service opportunities (Dodson and Sipe 2006; 2008). Global insecurity and uncertainty of oil supplies, resulting in rising fuel prices, serves only to heighten these significant spatial disadvantages. While the spatial characteristics of major cities around the globe may vary – in many American cities, for example, inner city suburbs are typically poorer than outer suburbs – there is ample evidence of the crippling effect that spatial disadvantage has on equity within cities (Badcock 1997; Sassen 2001).

Given the importance of cities, in terms of their ecological and social impacts and their predominance as the major form of human habitation, it follows that any attempt to ameliorate the impacts of human activities on ecological systems has to engage with cities. If we are to limit the impacts of climate change, provide water and food security, live well in the post-oil age, and avoid social polarisation, then the form and function of cities must change.

Sustainability has evolved to become the dominant discourse dealing with the human-environment relationship and how we might bring about changes in that relationship (Finco and Nijkamp 2001; Sneddon et al. 2006). It is a critical concept for society to grapple with, and an important one to explore in urban development. Its genesis lies in attempts to synthesise responses to the social and environmental challenges outlined above, and to instigate a changed development path. However, despite its extensive use and influence, sustainability remains a contested concept. The simplicity of the concept belies the complexity and debate surrounding its interpretation and implementation. The breadth of sustainability discourse means that it covers often contradictory terrain, and is characterised by vigorous debate (Diesendorf 1997; Mawhinney 2002; Connelly 2007). Sustainability appeals to scientific rationality about the nature of the human-environment relationship, while simultaneously appealing to social values around respect and protection of nature and equality within and between generations (Mawhinney 2002). It therefore straddles a complex space encompassing both 'objective' science and normalised values. As such, the application of sustainability is necessarily politicised and its implementation requires political decision-making.

Urban growth

Spatially, this research is focused on development in urban growth areas on the fringes of cities. These expanding growth areas, fuelled by rising population, pose particular challenges for the overall sustainability of cities. Their development typically involves the consumption of large tracts of peri-urban land to make way for large lot, low density, resource intensive housing, with residents highly reliant on car-based travel, and therefore high fuel consumption (Newman and Kenworthy 1999; Calthorpe and Fulton 2001). There is a strong argument that this form of development is fundamentally unsustainable and should be prevented (Knaap et al. 2007). Such urban fringe development is, however, current practice in all major Australian cities. Abandoning it completely would require a significant change in public and political practice and a radically different approach to the management of cities.

Urban fringe growth continues to be the dominant mechanism for accommodating growing populations in Australia. In Victoria, approximately half of all new dwellings

are built on the urban fringe (State of Victoria 2008a), despite a metropolitan strategic plan espousing containment and consolidation objectives, and seeking to direct the majority of new development to within the existing urban form (State of Victoria 2002). This containment and consolidation approach is evident in recent strategic plans for most major Australian cities, yet implementation to date has been limited and piecemeal (Hamnett and Kellett 2007; Bunker 2008). With urban fringe growth continuing to play a significant role in the growth of cities, it is essential that this form of development is subjected to analysis, and that mechanisms to improve its sustainability performance are sought.

This research is focused specifically on the development of MPEs, although relevance to a broader urban development context, particularly traditional large subdivision development and large scale estate infill development, will be discussed. MPEs are typically large scale, greenfield integrated housing developments consisting of hundreds, if not thousands, of dwellings. Their development is overseen by a single developer, who also provides and/or negotiates for key community assets such as recreational facilities, schools, shops and health services (Minnery and Bajracharya 1999; Dowling and McGuirk 2005a; McGuirk and Dowling 2007; Rosenblatt et al. 2009). They are therefore distinguished from more piecemeal fringe development by being a definable 'unit' of development. Because of the MPE's large scale and predominance in today's development market, it is a particularly significant unit of development in Australia. As such, the implications of MPE development is the subject of an active critical debate (Dowling and McGuirk 2005a; Gwyther 2005; McGuirk and Dowling 2007; Cheshire et al. 2009; Goodman et al. 2010), though there is little focus in existing literature on the emerging engagement with sustainability in MPE development. It is this gap in the literature that I seek to redress. In addition, the prominent role of MPEs in urban fringe development, combined with the single ownership model and status as a manageable 'unit' of development, present opportunity for intervention to change development practice and outcomes.

Operationalising sustainability

This thesis is located within applied urban planning research as it is concerned with the processes and mechanisms for influencing the outcomes of urban development. Mechanisms for influencing development can be usefully separated into two categories: regulatory 'command and control' processes and mechanisms; and non-regulatory or market-based processes and mechanisms. Both types of mechanisms exist in the Australian development sector in attempts to facilitate good urban development. Regulatory mechanisms include such measures as planning schemes and building codes, while non-regulatory mechanisms are more varied, and include a range of government and industry accreditation schemes and rating tools.

This inquiry investigates how sustainability discourse and sustainability principles are being incorporated into the delivery of MPEs – that is, the operationalisation of sustainability principles in a specific urban context. The term operationalisation is returned to regularly in this thesis, as it describes the particular nature of implementation that is of interest in the research. Operationalisation refers to the process of taking principles; interpreting them in a specific context; and developing methods to apply those principles to practice. In this thesis I explore the methods used in the development of MPEs to operationalise sustainability, focusing particularly on the increasingly prevalent use of performance and decision-making assessment tools. The analysis is concerned with assessment tools being used in, or targeted at, the development industry. These tools predominantly take the form of decision-making management frameworks, although there are some attempts at quantitative assessment of performance.

This research investigates the use of sustainability principles and discourse in informing how we live in, and develop, cities. Assessment processes have a key role in informing decision-making and evaluating progress against objectives (Brandon and Lombardi 2005). In an urban planning context sustainability assessment tools can "help planners and policy makers manage the built environment to better promote sustainability …help administrators explain and defend their decisions …[and] provide incentives and recognition for certain sustainable practices" (Retzlaff 2008:507). It must be

acknowledged that there is a significant subjective component to assessment, with the processes of developing and implementing assessment necessarily informed by ideologies, values, and agendas (Mawhinney 2002). Rather than dismiss attempts to assess and evaluate, though, I take the position that assessment processes are potentially valuable for understanding activity and informing future action when based on transparency and accountability (Hodge 1997; Roberts 2006). Further, that the efficacy and integrity of assessment approaches requires (and is improved by) ongoing critical interrogation. The task is therefore to examine how assessment approaches are used in the development sector, and how their use is affecting decisions in the development delivery process. Ultimately, the aim is not to seek a single 'correct' assessment approach, but instead to establish the effectiveness of different approaches in terms of sustainability and assessment principles and their operational impact. The result of the research is a presentation of findings that demonstrate the weaknesses in existing approaches, and also presentation of the principles and characteristics that must underpin the future development and use of such tools if they are to successfully aid the operationalisation of sustainability in MPE development.

1.2 Research Questions

An ontological starting point for this thesis is that sustainability performance assessment tools have the potential to facilitate change towards a better urban form. In recent years there has been increased attention on the development and use of such tools. While the majority of these tools have been focused on the building scale, precinct scale tools are also emerging. Across the range of tools, though, there remains limited critical evaluation or research into their effectiveness, or the appropriateness of their nature and use. With growing calls for the development and use of tools to help operationalise sustainability in urban development (Blair et al. 2003; Fyfe et al. 2008), there is a pressing need for research that critically examines the effectiveness of performance assessment tools for MPE development, and identifies how they might be improved. In this thesis I will address this need by focusing on the following question and sub-questions:

How can sustainability assessment tools help to effectively implement sustainability principles in the delivery of master planned estates (MPEs) in Australia?

1. What is the relevance of sustainability and sustainability assessment theory in the delivery of MPEs?
2. What constitutes effectiveness in sustainability assessment of MPEs?
3. How effective are existing sustainability assessment tools in operationalising sustainability principles in the delivery of MPEs in Australia?
4. How can sustainability assessment be more effectively used to operationalise sustainability principles in the delivery of MPEs in Australia?

Given the dominance of cities as forms of human settlement, and the impacts they have on ecological systems, research that leads to greater knowledge on how to reduce these impacts is critical. In answering the above questions, this research provides a valuable contribution to knowledge in urban planning and development. It will benefit governments by revealing the effectiveness of existing industry developed performance assessment tools in facilitating more sustainable urban development; and by providing policy direction for all levels of government to ensure rigorous and transparent sustainability assessment of urban development. Findings on the effectiveness of existing performance assessment tools, and on potential improvements to such tools, will also benefit industry, particularly the more progressive development players, bringing greater clarity and transparency to sustainability assessment of urban development, thus contributing to a fair and level playing field in sustainability assessment. Research findings will also benefit communities by providing transparent evaluation of existing sustainability assessment tools, and facilitating the development of more rigorous tools, thus increasing community and consumer knowledge of performance, capitalising on growing 'green consumer' sentiment as a driver for improved development practice. In combination these impacts may ultimately aid in reducing the environmental burden of urban development.

1.3 Research Methodology and Methods

This research considers the application of sustainability to cities, with a focus on the operationalisation of sustainability principles in MPE development. It examines sustainability assessment as a means of reducing the environmental impact of cities through facilitating change in urban development practice. As such, the research starts from the position that sustainability principles need to be better reflected in urban development, and that ways of understanding and operationalising sustainability in urban development are needed, and indeed possible.

In actively seeking better ways to operationalise sustainability, the research is necessarily critical of the existing human-environment relationship paradigm and acknowledges a fundamental need for social change. The focus of the research, sustainability performance assessment tools, are mechanisms that attempt to facilitate this change, and are grounded in the traditions of rational scientific inquiry: that is, that reality can be measured, evaluated, understood, and then used to inform future actions (Bryman 2004). The research acknowledges the potential utility and role of these tools to bring about change while asserting the need for critical evaluation. Advocating the use of such mechanisms to help create social change could open the research to criticisms of being in the tradition of social engineering. However, as Walker and Shove (2007:218) point out, efforts to facilitate sustainability increasingly accept and respond to the contested political realities of the sustainability debate, and "methods of '[social] engineering' are no longer, or at least not exclusively, conceived of in modernist terms". This research acknowledges the political context of the enquiry, and the subjectivity inherent in concepts of sustainability, and in the activities of assessment and evaluation. This social and political context is a critical consideration since politics and values affect all processes of decision-making. It therefore follows the lead of Sneddon et al. (2006), who advocate a pragmatic approach to research into sustainability theory by engaging openly and proactively with the subjective, value-driven aspects, as well as the technical and scientific underpinnings of sustainability.

Research methodology

This research examines existing approaches to sustainability performance assessment; investigates how assessment tools are being used and how effective they are; and, in learning from this investigation, proposes improvements. As such, it is applied empirical research, investigating real world problems and practice. O'Leary (2005) makes the case for the importance of applied research, noting that research on real world problems is required to answer questions that arise from practice, and to generate knowledge which can then facilitate practical evidence-based decision-making, thereby aiding problem resolution. Rather than inducing generalisable theory, applied research tends to focus on informing practice within a defined scope of inquiry. However, those carrying out applied research will also commonly seek to reflect on its findings, and in doing so identify elements that are transferable to related practice, or can contribute to theory building (Eisenhardt 1989).

O'Leary (2005) outlines four goals of applied research of which one or several may be targeted in a research project: understanding a problem; finding workable solutions; evaluating change initiatives; and working towards solutions. In the context of this research, the problem is well understood and defined (and is outlined in the introduction of this thesis, and supported and explained in the literature review chapters). Broadly speaking, the goal is to undertake a systematic program of research designed to expand knowledge in effective sustainability assessment of MPE development, through the identification and detailed interrogation of potential solutions, with findings ultimately contributing to better outcomes in the field.

The identification and evaluation of specific examples lends itself to the use of case study methodology. Case study methodology employs empirical enquiry to "investigate a contemporary phenomenon in depth and within its real-life context" (Yin 2009:18) and, as such, is congruous with applied research and its focus on real world problems (George and Bennett 2005). This research employs a comparative case study methodology, analysing and comparing multiple cases. A comparative approach is well suited to the particular research context, situated as it is within an emerging field of practice, with a limited number of relevant cases. Analysing multiple cases also enables

a greater breadth of analysis, providing the research with more rigour and therefore greater opportunity to produce findings that are transferable to other cases or generalisable to theory (Zartman 2005).

Cases of interest are selected according to their intrinsic value in meeting the aims of the research, as well as their relevance to the key theoretical or conceptual dimensions of the research. Bryman (2004:51) terms these "exemplifying cases", chosen because they "provide a suitable context for certain research questions to be answered". Following Fiss (2009), selected cases are not intended to be representative of a wider sample, but rather are employed in order to bring to light a more detailed understanding of a particular phenomenon – in this case sustainability performance assessment approaches used in MPE development.

The case selection process involves an initial review of literature and practice to determine potentially relevant cases, followed by the development of a set of criteria to evaluate relevance to the research purpose and scope. As Fiss (2009:427) states, "the phenomena under study should manifest itself clearly" in the case and it "should be easy to access this manifestation". These criteria are then applied to potential cases, finally resulting in the selection of case studies for detailed evaluation and interrogation. The selection of cases is therefore guided by the key concepts and theories from the literature (Zartman 2005). To study a 'case' it is necessary to clearly define the phenomena to be examined, thus delimiting the research (Fiss 2009). The cases identified for examination in this research are sustainability performance assessment tools, and so the primary material for the case study evaluation is the documented tool itself, as well as surrounding documentation, such as corporate reports, communications materials and critical literature. The organisational and operational context in which the tools are developed and implemented will also inform the case study investigations.

Given the development and application of criteria to evaluate cases, the research draws on evaluation methodology. Evaluation is a fundamental discipline of societies and is undertaken to determine the relative value of an initiative, such as a policy, procedure, or program, and to look for opportunities for modification and improvement

(Stufflebeam and Shinkfield 2007), and is therefore "crucial to rational, informed, or evidence-based decision making" (O'Leary 2005:208). The subject of evaluation in this research is sustainability assessment approaches targeted at MPEs. The research therefore adopts a process evaluation methodology, rather than an outcome evaluation methodology. That is, it evaluates the assessment tools themselves, and how they are applied, rather than the outcomes that are achieved. Process evaluation aims to provide data and findings that will aid the development of a particular change initiative (O'Leary 2005). It asks how well an initiative is being implemented and works to reveal the factors that are acting to facilitate and/or block successful implementation. Building on this, it asks how processes can be made more efficient and effective. Results of process evaluation are expected to inform decision-making related to program improvement, modification and management.

The case study based methodology employed in this research aims to influence real-world problems by informing the development of procedures, programs and policy (O'Leary 2005). At the program level, the research aims to make arguments for systematic change in how we conduct sustainability assessment of MPEs. It aims to assess potential programs – in this case, sustainability assessment tools and procedures – to explore strengths and weaknesses, gaps and opportunities. In addition, the research aims to have an impact at a broader policy level by attempting to contribute to guiding principles and policies regarding the development and assessment of MPEs.

While there are significant limitations to the generalisability of case study research findings due to the uniqueness of specific contexts, the use of a comparative case study approach has stronger capacity for theory building (Bryman 2004). Byrne (2009:3) argues that "multiple case studies founded on systematic comparison" clearly provide the bases for "useful theoretical descriptions of the social world". Building theory from case studies relies on "identify[ing] regularities, relations, effects, and generalizations and then – extremely important – the reasons behind them" (Zartman 2005:5). Utilising comparative case study methodology, this research aims to reveal how sustainability is conceptualised and operationalised in urban development. This places the research in the applied planning and urban development sphere, with a focus on contributing to

applied research and practice, providing greater understanding in order to move current practice forward. However, I also seek to consolidate findings from the case studies and identify generalisable elements where commonalities are evident (Eisenhardt 1989; Byrne 2009).

Research methods

The research utilises several functional methods to answer the research questions posed: literature and practice review; development and application of an analytical framework; and document evaluation. These methods are characterised by Yin (2009) as being appropriate to inform case study methodology, and are introduced in turn below.

The purpose of the literature review is to develop an understanding of the research and practice in relevant fields, establishing the research context. It identifies the key debates, concepts, and terms relevant to the research questions, and identifies the gaps in the literature which this research aims to fill (Grix 2001). Specifically, the literature review conducted for this research provides a broad overview and understanding of MPE development in the context of contemporary planning and development in Australia; of sustainability principles and theories; and of the application of these principles and theories to urban development, particularly MPEs. A further combined review of both literature and practice is used to identify sustainability assessment methods of relevance to the research questions and scope. The next step is to identify the assessment approaches for detailed investigation. This involves the development of selection criteria, based on relevance to the research focus, to apply to the suite of tools revealed by the review of literature and practice, resulting in cases of intrinsic interest being selected for detailed evaluation (Zartman 2005). The final aim of the literature and practice review is to provide a theoretical and conceptual basis for the analytical framework used in the research.

The principal means for evaluating the identified cases in this research is the application of an analytical framework which draws on the method of criteria-based assessment – a common method utilised in evaluation studies methodology (O'Leary 2005). This approach reflects methods used successfully in other related examples of interrogations

of sustainability assessment, such as Retzlaff's (2008) evaluation of green building assessment systems; Davidson's (2008) evaluation of corporate sustainability reporting; and Rametsteiner et al.'s (2011) evaluation of European Union sustainability indicator tools.

Evaluation can be defined as "the systematic assessment of the worth or merit of an object" (Joint Committee on Standards for Educational Evaluation [1994], cited in Stufflebeam and Shinkfield 2007:9). This research explicitly adopts this definition, using the notions of evaluating *merit* and evaluating *worth,* to inform development of the analytical framework. Evaluating merit essentially asks whether or not the subject of evaluation does what it is supposed to do, and involves the identification of the defined objectives of each assessment tool, and evaluation of the tool itself against those objectives. Whilst this is a valuable component of the research methodology, there are limitations to basing such an evaluation on merit only, since the objectives of each tool vary, and these objectives are defined by the tools' developers. As Stufflebeam and Shinkfield (2007:8) point out, evaluations "must avoid judging a program as successful solely because it achieved its own objectives", since "some objectives are unworthy of achievement", and "objectives might well be corrupt, dysfunctional, unimportant, not oriented to the needs of the intended beneficiaries, or mainly reflective of profit motives or other conflicts of interest of those in charge of the program". To strengthen the evaluation process, then, assessment of worth is also employed. Assessment of worth considers the quality or value of the assessment tools to serve a defendable purpose, rather than their own – often narrowly defined – objectives. The purpose of this research is to help facilitate decision-making and improve the sustainability performance of urban development, and this is therefore reflected in the elements of the analytical framework.

The framework is structured as a series of characteristics to evaluate the cases against. Each element of the framework is clearly defined and justified, drawing on the evidence and arguments presented in the literature review chapters. This helps to manage bias and subjectivity in the evaluation process by making the justification of the analytical framework as transparent as possible. The application of the framework follows what

George and Bennett (2005:68) refer to as the method of "structured, focused comparison" in case study research. It is 'structured' in the sense that a clear and justified list of characteristics is developed which reflects the research questions and conceptual foundation, thereby making systematic evaluation of cases possible and 'focused' in that the framework is applied to a specific set of cases.

This research uses documentation of practice as the primary source of data for analysis. Document analysis involves finding, accessing and evaluating documents, and is essentially an exploration of the evidence of what people have done (O'Leary 2005). In using documentation as a data source it is necessary to identify the nature of documents that exist, and the scope of documents that will be considered in the research (Duffy 2010). The primary source of data for the research is documented tools for assessing the sustainability of urban development, and associated technical, policy, communication and analytical literature. The research sources, selects and then evaluates sustainability assessment approaches that are relevant or applicable to MPEs. This data is primarily held by organisations involved in the development and application of sustainability assessment tools, and is generally available in the public domain.

Document analysis in social science research is often associated with a search for hidden meaning, agendas and intent, through employing discourse analysis and content analysis (Grix 2001). In the document evaluation approach used in this research, content analysis is employed in the initial assessment of the data in order to identify themes in the material. Specifically, the treatment of concepts of sustainability and sustainable urban development in assessment tool documentation is analysed, with particular regard to the nature and context of such occurrences. Evidence of these themes is illustrated with the use of brief quotations, diagrams or figures from the source material. However, the primary purpose of the document analysis in this research is to analyse the selected documents as part of an *evaluation* process, and the aims of uncovering hidden meaning are secondary at most. This document evaluation is best described as 'criteria-based assessment' and is based on the development of an analytical framework, as detailed above, which is applied to the assessment approaches being evaluated. Each assessment tool is then interrogated using the framework, with

responses sought against each characteristic documented in the framework. Analysis and synthesis of the outcomes of this evaluation provide the means to answer the overall research questions posed.

1.4 Thesis Outline and Summary

This first chapter has set the context, purpose and approach of the research undertaken. The review of literature and practice is presented in Chapters 2, 3 and 4. Chapter 2 considers the spatial context for the research. It examines urban planning literature, establishing the key planning debates informing the growth of cities, dealing with consensus and contention surrounding the issues of urban consolidation, mixed use development, and integrated transport and land use planning (Troy 1996; Newman and Kenworthy 1999; Goodman and Moloney 2004; Birrell et al. 2005; Buxton and Scheurer 2005a; Forster 2006). Different perspectives on institutional responses to sustainable cities' discourse is explored, particularly the relative merits of incentive or self-regulatory approaches versus government regulation (Williams and Montanari 1999; Gleeson and Low 2000; Perez-Arriaga and Linares 2008; van Dijk 2009). The chapter also establishes the focus of this research on MPEs, identifying the critical relevance of such development, and defining its spatial scale, characteristics, and process and actors associated with their delivery (Minnery and Bajracharya 1999; Blair et al. 2003; Gwyther 2005; McGuirk and Dowling 2007; Bajracharya et al. 2007). Further, it examines the influence of new urbanism (Talen 1999; Harvey 2001; McManus 2005) and sustainability discourse on this type of development. Finally the chapter provides a review of methods being used to operationalise sustainability in the delivery of MPEs.

Having established the focus on MPEs, and attempts to operationalise sustainability in MPEs through sustainability assessment, Chapter 3 examines the literature on sustainability, particularly as it pertains to urban development. This chapter reveals this as an immense and contested field (Wackernagel and Rees 1996; Mawhinney 2002; Connelly 2007). In navigating this field, the chapter provides the theoretical and conceptual foundation for the research that follows, establishing the basis of sustainability in environmental theory (Satterthwaite 1997; Hopwood et al. 2005; Low

et al. 2005); and the application of these principles to cities via both domain-based approaches (Campbell 1996; Hodge 1997) and system theory (Wackernagel and Rees 1996; Newman and Kenworthy 1999; Girardet 1999; Li 2007). The literature reveals the challenging and often competing appeals of sustainability to both objective (scientific) and subjective (values-based) conceptions of sustainability (Mawhinney 2002), and highlights the often ambiguous and contradictory application of sustainability principles in practice (Lélé 1991; Hopwood et al. 2005). The chapter concludes by highlighting the importance of clear and transparent engagement with sustainability principles such that any particular approach can be validly debated, assessed and accepted (or rejected) in the public realm (Lélé 1991; Sutton 2004; Connelly 2007), and by determining a set of relevant issues in the operationalisation of sustainability in urban development.

Chapter 4 engages with sustainability assessment as a mean of evaluating development proposals to guide the planning and implementation of preferred development options (Todd et al. 2001; Brandon and Lombardi 2005). It examines in detail the literature surrounding various approaches to the sustainability assessments of urban development, including the domains, or triple bottom line approach (Elkington 1998; Newman 2004); principle to indicator approaches (George 1999; Gibson 2000; Mawhinney 2002; Segnestam 2002; Pope 2003); and carrying capacity or metabolism approaches (Godschalk and Parker 1975; Wackernagel and Rees 1996; Wackernagel and Yount 2000). The chapter concludes by drawing from the literature critical requirements for sustainability assessment of urban development, including a clear objective and purpose; clear basis in sustainability principles; clarity, transparency, and rigour of methods; justification of the selection and prioritisation of issues through either the metrics developed or criteria selected; a process for accountability and continual improvement; and demonstrated feasibility in application.

Chapter 5 shifts from discussion and critical review of concepts and approaches to the interrogation of existing tools. Drawing on the previous literature examined the chapter first develops an analytical framework for application to assessment tools. The chapter

then turns to existing practice, examining existing assessment approaches that are suitable for use at the scale of MPEs, and selecting four cases for detailed interrogation.

In Chapter 6 each of the selected tools are analysed in turn through the application of the analytical framework developed in Chapter 5. The chapter provides a systematic and critical deconstruction of the case study tools against each element of the analytical framework. It reveals the strengths, weaknesses and opportunities of each tool under examination within the context of the examination criteria applied in this study

Chapter 7 provides a synthesis of the analysis presented in Chapter 6, with the critical review of literature from earlier chapters. The chapter first discusses the evaluation of existing tools, considering the merits of the tools, examining their ability to deliver on their objectives, and also the worth of the tools, evaluating their ability to improve the sustainability performance of MPEs (Stufflebeam and Shinkfield 2007). It presents findings on the strengths and weaknesses of existing tools, demonstrating that while all the tools have key strengths, and the potential to contribute to the operationalisation of sustainability in MPEs, there are significant weaknesses and a clear inability to effectively bring about significant change. The chapter then moves to a discussion of fundamental needs to ensure rigour and integrity; and desirable qualities that could greatly improve the effectiveness of sustainability assessment tools as mechanisms for operationalising sustainability in MPEs, based on the review and analysis work previously presented. Recognising that there are both technical and institutional responses needed to problems of sustainability in our cities (Sutton 2004), Chapter 7 concludes with an examination of tools in context – as mechanisms to be used in a process to help facilitate interpretations of complex issues and aid decision-making – highlighting the successes and limitations of non-regulatory approaches to operationalising sustainability in MPE development.

Chapter 8 concludes the thesis, drawing together the findings of the research, and addressing the research questions. It presents a discussion on the implications of the research for theory, policy and practice, arguing for a stronger role for government-led

assessment approaches as part of an integrated policy response to the development approval process.

Chapter 2: Development on the Fringe

Introduction

In an increasingly urbanised world, cities have become focal points of human activity and, consequently, the epicentres of anthropogenic impact on the natural environment. As urban populations have grown, so too has their urban footprint, both in terms of actual land area consumed by cities and, more conceptually, the extent of land required to service the cities' needs. The challenge for sustainable cities is to decouple human growth and development from growing consumption of ecological systems. This chapter is the first of three which engage with the literature to examine the intersection of sustainability with urban planning and development. It begins by establishing the context for suburban development in Australian cities, reviewing the origins and development of the suburban form. The contemporary Australian planning and governance context is considered, along with key influences and trends in development. Discussion then turns to an examination of the operationalisation of sustainability through the processes of planning and development of MPEs, establishing the key actors and their roles in these processes. The chapter concludes with a review of the MPE development sector's emerging engagement with notions of sustainability.

2.1 Cities and Suburbs

As a form of human habitation, cities have existed for thousands of years, since the first cities of Mesopotamia in the 4th millennium BC (Kostof 1991). Cities today are the dominant form of human settlement, comprising over half of the world's inhabitants (UNFPA 2009) – a figure predicted to rise to 80% by 2030 (UNFPA 2007). Australia is already a highly urbanised nation with more than three-quarters of the population inhabiting major urban centres (cities of 100,000 people or more) (Infrastructure Australia 2010:1).

Modern cities are hubs of political activity and power and are at the centre of the global economy, networked into global markets through transport and communication infrastructure. Being centres of population, economic activity and wealth, they are also

points of concentrated consumption, and therefore major sources of environmental impact. As urban populations grow, and lifestyle trends continue to move toward increased consumption (ABS 2007b), cities demand ever increasing inputs of resources, and discharge increasing amounts of waste (Girardet 1999; McManus 2005). The physical form of cities separates inhabitants from the ecological systems that sustain them – systems that provide food, energy, water and clean air, and assimilate wastes (Rees 2001; Low et al. 2005). This physical separation also engenders a psychological separation, diminishing the individual's sense of dependence on the environment and their awareness of the causal relationship between consumption and its environmental impacts, the result being the creation of "an urban universe that seems totally separated from nature" (Low et al. 2005:16). Given that cities are now the dominant form of human habitation, it is essential to confront the challenges of sustainability in urban contexts (Girardet 1999; Finco and Nijkamp 2001; Low et al. 2005).

The last one hundred years have seen many cities spread in an unprecedented manner through the creation of suburbs. The suburb has its roots in the industrialising cities of the United Kingdom in the eighteenth and nineteenth centuries (Fishman 1987). Poor living conditions in these cities – overcrowding, poverty and widespread disease – motivated a re-thinking of city form and function (Engels 1969; Hall 2000). The suburb evolved as an escape from these ills for the wealthy through the provision of cleaner, more wholesome residential environments (Fishman 1987). The primary physical means thought necessary to achieve this suburban ideal was low density development to reduce crowding, the separation of polluting industry from residential areas, and the integration of 'nature' to provide more cleansing environments. The resulting suburbs were low density residential areas, outside the core of the city, that predominantly excluded industry and commerce but were dependent on the surrounding city for employment, services, retail, governance, and cultural institutions.

The concept of the suburb was taken from its birthplace in the United Kingdom and Europe to the rapidly growing colonies of the New World, where it became the dominant urban form in major cities. Indeed, Australia has been referred to as the "first suburban nation" (Davison 1995:40; Davison 2006:206). The development of the

suburb in Australia is intrinsically linked with the evolution of transport in cities, as the location of suburban development has always been governed in part by the ability of residents to travel to and from their places of employment. Consequently, the growth of the suburbs has closely mirrored the proliferation of the automobile. The introduction of tram and rail corridors allowed many Australian cities to expand in a pattern of 'finger' development, but it was the meteoric rise of the private motor car that caused the most dramatic changes in city form and function (Davison 2004). The car, and the burgeoning road infrastructure that accompanied it, allowed citizens to travel when and where they wanted, so that suburb location was no longer reliant upon close proximity to public transport and other social infrastructure. The 'golden age' of development in the 1950s and 1960s saw massive suburban growth in Australia, and a huge shift to roads and cars as the mobility solution for cities. The United States, which is home to the most dramatic examples of low density car-based suburban sprawl, had become the new cultural model for urban advancement, and city planning and development was dominated by road construction authorities in the grip of "auto-mania" (Alexander 2000:110). The dominance of the car and road for mobility, combined with the low-density nature of development, gave rise to the sprawling car-based Australian suburbs of today.

2.2 Urban Planning and Governance

Urban consolidation

In the latter part of the twentieth century, a change in planning focus began to affect city planning and development, spurred on by calls from the environmental movement for greater consideration of sustainable development within planning strategies. There was a shift in emphasis to policies based on urban consolidation, mixed use development, and integrated transport and land use planning, in an attempt to reduce dependence on the automobile and the outward growth of cities (Forster 2006).

Consolidation is commonly proffered as a means of minimising urban sprawl and car dependency, with proponents arguing that increased densification results in greater economic efficiency in the provision and use of urban infrastructure, and improved

access to employment and services for residents (Newman and Kenworthy 1999; Low 2002; George 2002; Goodman and Moloney 2004; Buxton and Scheurer 2005b;). Within the urban planning field, however, there is by no means universal support for this 'contain and consolidate' approach (Searle 2004), and many question the effectiveness and viability of urban consolidation to achieve better urban outcomes. Birrell et al. (2005) highlight the significant impact that an urban consolidation agenda has on existing urban areas, and argue that the traditional suburban form should be protected from infill development. Others share the environmental concerns underlying arguments for urban consolidation, but are sceptical of its ability to deliver the claimed benefits (Troy 1996; Randolf 2004; Searle 2004; Mees 2010). They advocate a cautionary approach, pointing to the negative effects of consolidation on the amenity of existing suburbs, such as reduced block size and therefore reduced garden size, detrimental impacts on existing neighbourhood character, increased congestion, and higher demands placed on existing community infrastructure. Troy (1996) goes further, arguing that sustainability goals would be better achieved by using the low density suburban form of house and garden, with its potential to facilitate domestic food production and support urban biodiversity. Nonetheless, the 'contain and consolidate' or 'compact city' paradigm remains increasingly evident in the strategic plans of many major Australian cities (Bunker 2008; Bunker and Searle 2009).

Intervention versus a free market

Calls for urban consolidation and substantial changes to existing urban form suggest an increased need for planning intervention in development markets. This, however, is somewhat incongruous with the neoliberalist governance approach that has come to dominate Australian policy making in recent years (Gleeson and Low 2000; Mees 2003). Neoliberal ideology elevates the rights of the individual and champions the ability of markets to most effectively allocate goods and services whilst maximising economic returns (Harvey 2007). Neoliberal governance is therefore characterised by a loosening of regulatory control to favour free market approaches and industry self-regulation. As McCarthy and Prudham (2004:276) point out, neoliberal enthusiasm for the market "goes hand-in-glove with political and ideological antagonism toward state 'interference' (i.e. regulation)" and, as such, advocates of a free-market approach to

urban development are typically against almost any planning intervention. Such advocates argue that there is ample land available for the development and expansion of cities in Australia and that market mechanisms are the most suitable to judge the viability of urban expansion on the fringe (for example, Cox 2005; Moran 2006a, 2006b). This line is strongly advocated by the sections of the development lobby focused on greenfield development who argue that containment and consolidation policies force up the cost of land on the fringe, leading to reduced housing affordability (Cooke 2005; Day 2006).

Both urban planning and sustainability have, at their core, goals relating to notions of collective benefit – or 'common good'. While the specifics of these goals are debated, along with the nature and degree of intervention required to achieve them, it is widely accepted within the planning field that market intervention is needed to effectively manage the growth and development of cities (Low 2008; Adams and Tiesdell 2010). Therefore both urban planning and urban sustainability objectives potentially conflict with the central tenets of the neoliberal agenda. As Hamnett and Kellett (2007:279) identify, "planning takes place against a backdrop of tensions between state intervention in pursuit of collective goals and the operation of markets based on private property rights". They observe that there is conflict between the desire to contain growth through mechanisms such as urban growth boundaries on the one hand, with "the aggressive lobbying activities of house-builders … and the political pressure to release more land for housing at the urban fringe" (2007:278) on the other.

This tension between free markets and regulation is examined by Perez-Arriaga and Linares (2008) in their investigation of the energy supply sector in Europe. While acknowledging the strength of the market in efficiently allocating resources and stimulating private investment, the authors highlight significant weaknesses where sustainability is concerned. These include the entrenched coupling of economic growth with increased resource consumption and the short-term focus of markets, making it difficult to factor in long term strategic considerations around resource availability and negative externalities. They argue that innovations to internalise such externalities have some success, but that additional regulatory mechanisms are also needed to establish

and achieve sustainability objectives and targets. Similar conclusions are presented by van Dijk (2009) when examining the strategic urban planning issue of open space preservation in the face of growing development pressure on the urban fringes of cities. He examines the effectiveness of Tradable Development Rights (TDRs) in the United States as market mechanisms to protect open space. He argues that they are only successful when supported by strong regulatory frameworks: "in order to succeed, it is crucial for TDRs to be placed in the context of a larger, comprehensive land use plan that has specific goals for urban development and land conservation" (2009:352). That is, TDRs is not an effective mechanism in the neoliberal objective of *replacing* regulation, but instead requires "comprehensive metropolitan planning and government interference" for success. Therefore van Dijk concludes that neoliberalist planning systems fail to deliver on the protection of public open space, and that increased interventionist action from governments is required.

The impacts of neoliberalism on planning have been significant, exemplified by the "deregulation and privatisation of the public housing sector and the reorientation of planning capacities away from spatial equity towards entrepreneurial and competitive cities paradigms" (Cook and Ruming 2008:212). Gleeson and Low (2000:24) provide a critical analysis, arguing that as a result of neoliberalism "planning has been outsourced, privatised, marketised and stripped of the knowledge and confidence that informed its founders". McCarthy and Prudham (2004:275) highlight that the neoliberal agenda, through its commoditisation of nature, tends "to generate serious environmental consequences". Gunder and Hillier (2009) argue that the neoliberal agenda has had a significant influence on sustainability discourse, with the potentially transformative concept of sustainability being redefined and sanitised and repackaged as 'sustainable development'. In implementation, they argue, this has become a mechanism for reinforcing capital growth and market mechanisms as dominant decision-making paradigms (an issue returned to at length in Chapter 3).

Examining the rise of the neoliberal agenda in metropolitan planning and governance in Australia, McGuirk (2005:62) argues that influence on these fields is sometimes overstated. She argues that in practice an "after-neoliberalist" hybrid approach has

emerged, with partial adoption of deregulation and market mechanisms, but with "substantial planning capacity and state agency" remaining in a social democratic tradition, affording the potential for "new and different spatial and social distributional outcomes than those framed by a neoliberalised imagination". This hybrid conception is reflected in Minnery's (2007:330) observation that urban planning governance reflects a convergence, rather than divergence, of "both neo-liberal and communitarian ideologies". Healey's (1998) earlier analysis of the relationship between regulation and the urban development industry in the United Kingdom perhaps provides a template for such 'after neoliberal' planning policy. Healey calls for a greater emphasis on building capacity and facilitating change in order to achieve sustainability objectives, rather than traditional control mechanisms. She suggests that the role of urban policy is to provide "institutional *capability* to mobilize for policy objectives" as well as to ensure "the environmental, social and economic *sustainability* of urban dynamics" (1998:212). She argues that urban policy must therefore facilitate a property and land development sector that can continue to deliver investment in urban areas whilst also ensuring this investment addresses pertinent quality, cultural and social objectives by providing the necessary regulatory framework. Further, she argues that urban policy needs to facilitate capacity and change in the development sector to enable investment to meet these objectives.

Metropolitan strategic planning

There is some evidence of McGuirk's (2005) hybrid approach in the spate of strategic plans released between 2002 and 2005 for Melbourne (State of Victoria 2002), Perth (WAPC and Department of Planning and Infrastructure 2004), Sydney (NSW Department of Planning 2005), and South East Queensland (Office of Urban Management 2005), all of which have a focus on containment and urban consolidation within a framework of aspirational, vision-based guidelines (Forster 2006; Hamnett and Kellett 2007). Reflecting a trend away from more comprehensive metropolitan strategies, the plans employ sustainability rhetoric to frame urban goals, favouring what McGuirk (2005:64) describes as "flexible, place-focussed, outcomes-oriented, holistic planning". The result is plans that contain limited regulatory mechanisms, and strategies and targets for consolidation that are almost always aspirational rather than

mandatory (Buxton and Scheurer 2005b). As such, these strategic plans have been widely criticised for endorsing urban consolidation whilst lacking the policy controls to determine where and how this consolidation occurs, allowing developer pressures to drive excessive and often inappropriate consolidation in existing urban areas where land values are high (Troy 1996; Birrell et al. 2005; Buxton and Scheurer 2005b). However, the plans do include some regulatory mechanisms. For example, in Victoria, the current strategic plan, *Melbourne 2030* (State of Victoria 2002), sets a clear agenda for shifting development from fringe expansion to consolidation in strategic locations within the existing urban form, including the establishment of an Urban Growth Boundary (UBG); and legislative protection for a belt of 'green wedge' land around the metropolitan area (State of Victoria 2002). Such examples, McGuirk concludes, reflect "an important moment in the reinstitutionalisation of the state", through a "reassertion of the metropolitan planning agenda" (2005:67).

Yet the implementation of these initiatives often tells a different story: one that supports the assertion that developer pressure and market led decision-making are the dominant forces underpinning metropolitan planning. This is exemplified in Victoria, where a raft of actions and amendments since the 2002 release of the *Melbourne 2030* strategy has fundamentally changed its initial 'contain and consolidate' agenda. *Melbourne 2030* set an aspirational target for urban fringe net densities of 15 lots per hectare by 2010 (State of Victoria 2002). This is a relatively unambitious density target, yet increases in density in urban fringe development have been minor and piecemeal at best, with little increase to the average 9.6 lots per hectare (Buxton and Tieman 2005). A similar approach was applied to urban consolidation, with a target to reduce the proportion of urban fringe development from 38% to 31% by shifting the focus of new development into the existing urban area to strategically identified activity centres (State of Victoria 2002).

However, several government actions since the release of *Melbourne 2030* have undermined commitment to this strategic vision. These actions include the expansion of the urban growth boundary in 2005 (State of Victoria 2005) and 2010 (State of Victoria 2010a). Urban Development Program audits show an increase in the proportion of

urban fringe development since the release of *Melbourne 2030*, not a decrease, with development tracking at an approximate 50:50 split between fringe growth and urban consolidation since the release of *Melbourne 2030* (State of Victoria 2008b). In December 2008, the Victorian Government released *Melbourne 2030: a planning update – Melbourne @ 5 million* (State of Victoria 2008b). This 'update' had a significant focus on investigating large tracts of Melbourne's green wedges for further expansion of the urban growth boundary and, as such, some critics saw it as the end of the *Melbourne 2030* strategic agenda (Goodman 2009), with prominent planning academic Michael Buxton publicly declaring *Melbourne 2030* "stone dead" (Dowling and Lahey 2009:1). The update effectively abandoned the original *Melbourne 2030* consolidation objectives, locking in existing practice and proposing that 47% of development be accommodated on the urban fringe over the life of the plan (State of Victoria 2008b). The release of *Delivering Melbourne's Newest Sustainable Communities* in June 2009 (State of Victoria 2009) and subsequent changes to the urban growth boundary in July 2010 (State of Victoria 2010a) arguably represents the final death-knell for *Melbourne 2030's* containment approach, significantly expanding the urban growth boundary and annexing swathes of former green wedge land to cater for urban fringe growth corridors, while claiming to pursue 'sustainable communities'.

2.3 Urban Fringe Development

Cities accommodate growing populations though a combination of redevelopment within the existing urban form and new development on the urban fringe. Despite significant focus on consolidation and containment in metropolitan plans, a large proportion of urban population growth in Australia continues to be accommodated through the expansion of the urban fringe, as exemplified by the Melbourne example above. Today, the majority of development on the urban fringe takes the form of residential subdivisions or MPEs, with a minority of small scale or single entity developments (Blair et al. 2003). These forms of development respond to markedly different pressures, constraints and opportunities than infill development, which tends to take the form of either individual dwelling developments, small multi-unit developments or high density developments (Ruming 2010). It is rare that large residential subdivisions or MPEs are developed within existing urban areas (Webster

2004; Ruming 2010), although there are exceptions when larger brownfield sites are redeveloped (for example Kensington Banks in Melbourne (Buxton and Scheurer 2005a) and Beddington Zero in London (Chance 2009)).

Suburban growth on the fringe presents a complex set of problems and impacts, which sets it apart from other forms of urban development (Dowling and McGuirk 2005b). As the physical bounds of existing cities expand, new suburbs consume greenfield land on the urban fringe, replacing established ecosystems and threatening surrounding areas through the encroachment of intensive human activity and depletion of local biodiversity. Local bioproductivity is also affected, with urban expansion subsuming previously productive agricultural land. Large scale fringe development has an added challenge in the delivery of the physical and social infrastructure required and expected by citizens (Dowling and McGuirk 2005b). While road access, water, and electricity are now routinely provided for new estates, the provision of other infrastructure such as public transport, schools, retail, health, and community and recreational facilities is not always included at the time of construction and there may be a significant time lag in their provision. Providing access to public transport in urban fringe locations, dominated by low density development, is particularly challenging. Consequently, private cars are used to meet nearly all mobility needs, resulting in high fuel consumption and GHG emissions. While there are a number of key variables that contribute to the success of public transport systems in low density urban environments, such as service frequency and quality, and urban design (Mees 2000, 2010; Bamford 2009), conventional wisdom in Australia has been that higher population density is required to make public transport viable in urban fringe development (Buxton and Scheurer 2005b ; Kenworthy 2007; Roberts 2007). Attempts to increase the density of developments, however, are hampered by established expectations of lot and dwelling size held by homeowners purchasing in fringe areas, so there has been reluctance in the private development sector to change established practices in delivering housing products to the market.

Master planned estates (MPEs)

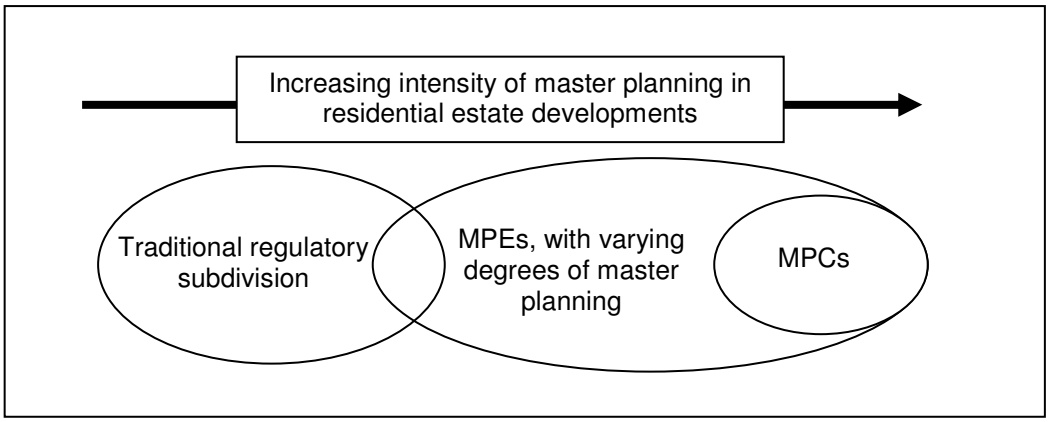
An increasingly prevalent form of residential growth on the urban fringe in Australia is the MPE or master planned community (MPC) (Costley 2006; McGuirk and Dowling 2007). The defining characteristics of MPEs (outlined in Chapter 1) are their large scale and their centralised control by a single developer (Minnery and Bajracharya 1999; Dowling and McGuirk 2005a; Rosenblatt et al. 2009). Importantly, such developments are also viewed as discrete projects by planning authorities and treated as such through key phases of the planning approval process. The MPE can, therefore, be considered a definable 'unit of development', and one that is particularly worthy of investigation, due to its large scale and its increasing prevalence in the Australian development market, most notably on the urban fringe.

Within the residential estate development sector, there is great variance in the degree to which developers engage in measures that can be described as 'master planning'. Several authors have therefore attempted to characterise approaches to residential estate development along a spectrum of intensity of master planning (Figure 1) (Blair et al. 2003; Dowling and McGuirk 2005a; Gwyther 2005; McGuirk and Dowling 2007). At one end of the spectrum is the more conventional residential development, typified by regulation driven subdivision and a focus on the street, block and essential physical infrastructure layout. This type of development rarely has additional building controls above relevant planning regulation (Blair et al. 2003:3). MPEs, however, involve a greater engagement from the developer in master planning, and typically include the provision of integrated physical and social infrastructure. Along with this greater focus on the provision of lifestyle or social infrastructure elements, there is an increasing use of developer-imposed design controls (McGuirk and Dowling 2009) (see for example the building design requirements for VicUrban's Aurora development (VicUrban [2004]). At the most intensive level of master planning is a focus on the creation of 'communities'. The MPC sees an additional developer focus on place-making, nurturing social integration and community sentiment, and the formation of what Gwyther refers to as the 'community compact':

> The community compact is a broad agreement between the planner-developer and the residents as to the primary *development goal* and the

> dominant value system or *common social code* which is intended to operate within the estate (Gwyther 2005:59, *original emphasis*).

Figure 1 – Intensity of master-planning in new residential estate development.



(After Blair et al. 2003; Gwyther 2005)

Rosenblatt et al. (2009:123) suggest that to "a large extent, the motivation to master plan a community is an economic one and arises from the boost in sales to property developers that the package deal … affords". However they note that "some developers of MPCs have also recognized the need to operate in a socially responsible manner and to provide residential estates that meet social and environmental, as well as economic, objectives" (2009:123). In particular, estate developments purporting to have 'green' credentials are typically MPEs (Rosenblatt et al. 2009). Examples of this include Mawson Lakes in South Australia developed by Delfin (Delfin 2005); Aurora in Victoria developed by VicUrban (VicUban 2007); and Lochiel Park in South Australia developed by The Land Management Corporation (Blaess et al. 2007).

Blair et al. (2003) identify significant potential to reduce the environmental impact of residential development through better design and more effective use of land and infrastructure. They suggest that the master planning process can facilitate and encourage the consideration of environmental design elements, and highlight the potential for developer-led design, guidelines and controls to ensure better environmental performance at both the lot level and subdivision level. At the lot level, for example, this may include requirements for the provision of solar access and the use of eco-preferable materials, efficient appliances, photovoltaic panels and water tanks.

At the sub-division level, it may include the provision of community facilities, localised services, and maximising pedestrian accessibility and walkability. However, this potential does not necessarily predicate changed outcomes, with research conducted by Yigitcanlar et al. (2007) examining travel self containment showing that existing MPEs are still highly dependent on the private car, inhibiting a more sustainable transport profile.

Despite potential benefits, there is also considerable criticism of the MPE as a development form, particularly from those who question the role of private interests in the provision of social infrastructure. The trend towards MPEs is seen by some as representative of a general move toward the privatisation of public space and services that is favoured by neoliberalist policy, of which the 'gated community' could be considered the ultimate expression (Gleeson 2002; Gwyther 2005). Although, as McGuirk and Dowling (2007) point out, this privatisation of infrastructure and service, which is common in the United States, is not such a strong feature of Australian MPEs. Rather, the planning, delivery, and operation of MPEs in Australia tends to be governed by hybrid forms of public and private guidelines and regulations. MPEs are also criticised for their focus on the questionable notion of 'creating community', with suggestions that their marketing actively trades on promises of exclusivity and social status (Gwyther 2005; Costley 2006). Rosenblatt (2005:4) describes this "commodification of community" in his examination of MPCs in South East Queensland, noting how notions of community are packaged and marketed to sell a residential development to a potential home owner, in much the same way that other commodities are marketed to consumers.

The growing importance of the MPE as a unit of development in Australia is reflected in the growing body of research characterising and examining its rise, and the fact that the most active critical debate around the issues associated with residential estate development tends to be centred on MPEs. Its single developer control also makes this particular unit of development potentially more accessible and susceptible to planning intervention measures and mechanisms intended to influence the decision-making processes involved in planning, design, development and delivery. As Dowling and

McGuirk (2005a:1) identify, MPEs are now "crucibles of urban change, … [with] the potential to reshape urban residential structures and refashion ways of relating in urban residential neighbourhoods …[and] thus require more rigorous analysis".

New urbanism

The notion that community can be 'created' through urban design reflects a new urbanist planning philosophy and some of the criticisms of MPEs stem from critiques of new urbanism, which is often identified as influencing the MPE development approach (McGuirk and Dowling 2007). New urbanism has had a particularly strong influence on development in Australia (McManus 2005), with its principles widely evident in strategic planning documentation. The design philosophy is also evident in many of the residential estates recently built in Australia (Rosenblatt et al. 2009). For example, the design of VicUrban's Aurora estate is significantly informed by new urbanism design principles (Aurora Development Director, cited in James Hardy 2007).

New urbanism emerged in the 1980s in the United States as a response to the perceived negative impacts of growing cities, and was formalised in the 27 principles of the New Urbanism Charter, first published in 1996 (CNU 2001). The Charter identifies new urbanism as a movement aimed at creating "real neighborhoods", through the restoration of existing urban areas and the creation of new developments (CNU 2001:1). Its principles advocate urban infill and redevelopment over urban expansion, and are critical of "bedroom suburbs" and urban sprawl (CNU 2001:2). The Charter calls for the creation of functioning and diverse neighbourhoods with integrated civic, institutional, and commercial activities; compact development with higher densities, especially around public transport nodes; and a diversity of housing options, including affordable housing. It encourages pedestrian-friendly development to enable walking access to daily activities. This is supported by a general focus on reduced automobile dependence, seeking to maximise walking, cycling and public transport as alternatives to the car. New urbanism also aims to revitalise 'community' in suburbs through neighbourhood designs and layouts that foster community interaction and the formation of community identity. It sees building and urban design that responds to local history, ecology and climate as integral to creating community identity, as well as conserving

natural environments. While not overtly characterised in the language of sustainability, the concerns of new urbanism clearly overlap with the fundamental elements of sustainable urbanism; and in practice the terms are used "almost interchangeably, in relation to a constellation of principles that they advocate or resist" (Grant 2009:29).

The merits of new urbanism as an approach to urban development have been widely debated in both practical and academic arenas (for a comprehensive bibliography of research, see Rowland and Talen 2005a; 2005b). Some critics fundamentally disagree with new urbanism's focus on reducing urban sprawl and the ecological impacts of development (Gordon and Richardson 1997). It is also subject to criticism from those who would agree with the central premise that action is needed to reduce the ecological impact of cities and redress social disadvantage, but question the influence that new urbanism can have, particularly since it is primarily a physical design philosophy (Troy 1996; Harvey 2001).

The tendency to draw inspiration from historical design, particularly evident in early flagship new urbanist developments such as Seaside, Florida, has been criticised as a romanticisation of past urban environments and concepts of community. This neo-traditional design focus is dismissed by some as backward looking and simplistically nostalgic (Brain 2005), while others go further, suggesting it is distressingly similar to classical forms of utopianism (Talen 1999; Harvey 2001). Advocates of new urbanism point out that the movement is now represented by a diversity of developments, some with very contemporary designs, and that the neo-traditional 'greenfield' characterisation of new urbanism is outdated, overly simplistic and unrepresentative (Ellis 2002).

Perhaps the most strongly criticised element of new urbanism is the perceived undercurrent of physical determinism evident in its principles, which advocate the use of design to foster community (Talen 1999; Harvey 2001; Brain 2005). The notion of a causal relationship between the physical urban form (and aesthetics) and the behaviour of citizens, is widely disputed (Talen 1999; Brain 2005). Critics point to a host of important variables that influence the behaviour of citizens and the development of a

'sense of community' in urban environments, such as the degree of social homogeneity, socio-economic status, length of residence, presence or absence of children, employment status, home ownership, and perceived area prestige (Talen 1999). New urbanism, some argue, seems to privilege the effect of spatial form over social process (Harvey 2001). In defence of such criticism, Ellis (2002:278) argues that "one does not need to be an environmental determinist to acknowledge that design has important influences on behaviour", and contends that new urbanism seeks only to maximise the potential for social interaction as a critical aspect of the creation of community.

Criticisms of the social impact of new urbanism include concerns about the potentially divisive nature of new urbanist developments, in particular the undercurrents of 'othering' that can be embodied in notions of creating community identity and pride. Brain (2005) highlights the contradiction between the goal of *urbanism* – with its implications of diversity and complex cultural interplay – and the goal of creating *community*, centred on creating commonality and connection. Efforts to 'create community' through design, marketing, and social programs are more encouraging of territorial tendencies and resident homogeneity than of acceptance of diversity (Talen 1999). Fostering community, it is argued, can actually act as a "barrier to rather than facilitator of progressive social change" (Harvey, 2001:3), exacerbating social fragmentation, rather than facilitating harmonisation (Talen 1999). The concern is that new urbanism reinforces class privilege and social division, building an "image of community and a rhetoric of place-based civic pride and consciousness for those who do not need it, while abandoning those that do to their 'underclass' fate" (Harvey 2001:3).

Whether they explicitly draw inspiration from new urbanism or not, the focus on 'creating communities' is widespread in the MPE development sector (Rosenblatt 2005; Rosenblatt et al. 2009). As such, the criticisms and concerns raised in relation to new urbanism are equally applicable to the MPE development sector. McManus (2005) suggests that new urbanism's influence on development practice in Australia is manifest in two distinct ways: with interpretations that tend to adopt either its progressive urban design focus or its 'neo-traditional' focus. The progressive design approach is

characterised by the provision of higher density walkable neighbourhoods, transit orientation, and mixed-use and diverse neighbourhoods; and as such is an approach more analogous to elements of sustainable urbanism. However, McManus expresses concern that the new urbanist influence in Australia is more often manifest via the 'neo-traditional' approach, with a focus on neo-traditional housing, themed development, and the 'creation of community', rather than on innovative urban design intended to reduce car dependency and resource consumption. This loss in application of the more progressive elements of the new urbanist approach is echoed in Grant's (2009:15) analysis of new urbanism's influence on planning policy in Canada, where she notes that "although many cities have adopted the rhetoric of new urbanism … in their policies and plans, development patterns in North American suburbs often remain single-use and car-dependent".

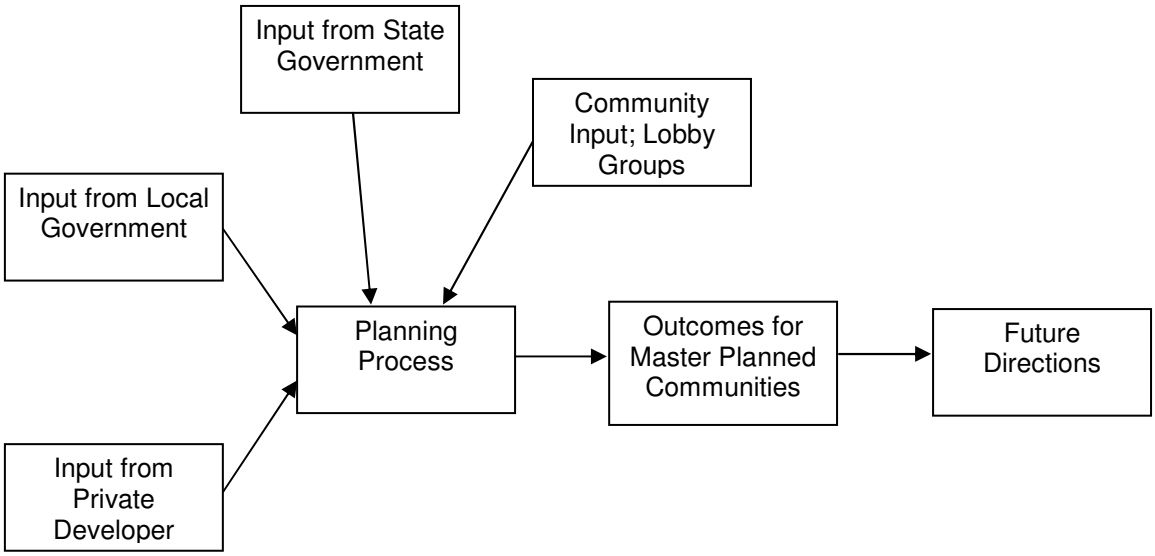
2.4 Delivering Master Planned Estates

Tools intended to improve the sustainability performance of MPEs must work within the existing development delivery context, facilitating change by influencing the key actors, processes and governance mechanisms involved. Healey has provided key reviews (1991) and contributions (1992) to theorising this development context, examining stages of development delivery, and associated actors and roles. In a similar vein, Minnery and Bajracharya (1999) provide a conceptual representation of MPE development delivery (Figure 2), which highlights the multifarious roles involved, including the developer as the project proponent, both local and state government as the relevant planning authorities, and community and industry lobby groups.

Ruming (2010) categorises urban developers into three types: small; medium; and large, noting the prevalence of small and medium developers acting in existing urban areas, versus the prevalence of large developers on the urban fringe. In the housing or housing estate development sector (as opposed to high density multi-apartment developments) the tendency for large developers to focus on the urban fringe is due to the limited availability of large sites in existing urban areas, and the perceived lack of a market in these areas for the housing product that they offer. The developers of MPEs wield significant influence in the policy settings surrounding the delivery of residential

estates, both because of the large size of their developments, and the scale of their business operations (Bajracharya et al. 2007, Ruming 2010). In addition, the residential development sector is relatively concentrated, with a small number of large developers active (Coiacetto 2007a; 2009).

Figure 2 – Framework for analysis of master planned communities.



(Minnery and Bajracharya 1999)

The single developer control is a critical characteristic of MPEs, though governance models vary. Bajracharya et al. (2007:188) identify "three distinct governance structures of master planned communities – single developer model, principal developer model and government led model". In the single development model "visioning, planning, and implementation of the community… [are] under the auspices of a single organisation" (Bajracharya et al. 2007:189). MPEs where the developer takes complete control of construction along with the coordination and master planning are in the minority in Australia and are typically at the smaller end of the MPE development scale in terms of size. They are more common in niche development such as golf club developments and other lifestyle developments (see for example Macquarie Links Estate (Kenna 2007)).

The principal developer model sees "the leadership of an MPC development process by a central controlling entity that then contracts separate companies to implement the building of separate sections or aspects of the community" (Bajracharya et al. 2007:189). The developer is the central coordinator and proponent of the residential estate project. They have control of the overall development and have responsibility for developing a master plan and coordinating the implementation of the development. However, developers of MPEs commonly do not deliver the built infrastructure, drawing instead on contractors to construct individual housing and provide infrastructure. Volume building companies who are structured to cater to this scale of residential housing provision are therefore important contributors to the development process.

The third governance model identified by Bajracharya et al. (2007) is the government led model, which the authors describe as a "bringing together by government of a number of separate private land owners and development companies in order to guide the process of community building towards a set of objectives" (2007:189). Focusing on South East Queensland examples of the government led model, the authors describe instances where a local government takes the lead in coordinating a master planned development (see also Coiacetto and Baker 2007), though Bajracharya et al. (2007) note that at the time of writing Queensland did not have a government established development authority. Most state governments have now established such authorities, so a more useful understanding of the government led model would be those that involve the leadership of these quasi-government agencies. A significant portion of the urban development market is currently occupied by state government development agencies: VicUrban in Victoria; Landcorp in Western Australia; Landcom in New South Wales; Land Management Corporation in South Australia; Urban Land Development Authority in Queensland; ACTPLA in the Australian Capital Territory (though this is primarily a planning authority with a limited developer role); and the Northern Territory Lands Group. These are corporatised agencies typically having both a public policy purpose, and a requirement to deliver profits to government. These agencies follow a similar delivery model to that of the 'principal developer' model discussed above, in

that they retain control of the overall master planning and implementation, but involve a wide range of contractors to deliver the built form aspects of the development.

While the detailed master planning of MPEs is usually the domain of the developer, state and local government control the strategic planning context and the planning approval process. The planning system and process, established and administered by government, sets both the strategic framework within which MPEs can be proposed and developed, and provides the approval process for implementing projects (Minnery and Bajracharya 1999). It is this framework which provides the local council (or other designated planning authority) with mechanisms to influence development outcomes. The final product of the MPE development process can therefore be considered a negotiation between public vision and interest (represented by government planning processes) and private developer interest and the master planning process (Minnery and Bajracharya 1999).

Minnery and Bajracharya (1999) suggest it is inaccurate to cast the negotiation between developer and local council as simply adversarial, highlighting the benefits that councils gain from dealing with large developments under the control of a single developer as opposed to numerous and disparate small developers, in terms of getting consistent and significant outcomes for the community. They also point out the potential for large developers to leverage their profile to attract more support for major infrastructure components from state and federal funds. They report the government-developer relationship as complex and widely variable, with some local governments viewing large developments as central to their growth agenda and others wary of the increased private control over community planning, citing concerns about adequate provision of community infrastructure, privatisation of community infrastructure, and satisfactory treatment of environmental issues (for example see Goodman and Douglas' (2008) examination of the privatisation of community infrastructure via MPEs).

In Australia, state governments are responsible for the planning regulatory system and typically also assume responsibility for developing metropolitan strategic planning policy. State governments also wield influence through their responsibility for major

infrastructure delivery. Typically, local governments are delegated planning powers to develop local strategic direction within the frameworks set by the state and execute the statutory development approval process. However, state governments and the planning ministers retain significant influence on local planning, with a variety of mechanisms in place which enable the minister to bypass or over-rule elements of the local government administered planning process, raising "questions in respect of the role, power and influence of local council" (Hamnett and Kellett 2007:278). Examples of these mechanisms include greater ministerial control via 'call in powers' (Gleeson and Low 2000); the establishment of priority development zones; and the establishment of regional planning authorities with delegated planning authority in growth areas.

The primary authority charged with providing and maintaining community services is local government. In the case of MPEs, where developers increasingly play a role in the planning and provision of local services and facilities, there is typically a handover phase in which local government progressively takes on responsibility for the ongoing governance and service provision to the new development. The tension between the roles of the developer as master planner and local government as the ultimate management and service provision agency is the source of much debate and contention (Goodman and Douglas 2007). While a developer is in the active selling phase of a development, which can last for many years, they have a vested interest in the physical appearance, smooth operation, and level of resident satisfaction; however, once selling is completed, this interest is removed, and the developer moves on to the next project, leaving management and upkeep in the hands of local government or to an owners corporation (Cheshire et al. 2009; Goodman et al. 2010).

Well-organised community lobby groups are active in many existing urban areas where they can be highly effective in influencing the land development sector (Gleeson and Low 2000). However the influence of community lobby groups is less pronounced in greenfield development on the urban fringe, where the NIMBY ('Not In My Backyard') response is less prevalent – the absence or limited existence of established community means limited local reaction. Therefore target community pressure is less evident and, if present, manifests itself more in casual lobby groups. An example of this is the Green

Wedges Coalition in Victoria, a collection of community groups focusing on the protection of green spaces from urban expansion, which played an important role in lobbying government for the protection of the green wedges around Melbourne in *Melbourne 2030* (Mees 2003), and ardently opposed the subsequent dismantling of green wedges in recent years (Green Wedges Coalition 2009). Developer lobby groups, however, are very active on the urban fringe where peak industry groups such as the Urban Development Industry Association and the Housing Industry Association wield powerful influence (Gleeson and Low 2000; Hamnett and Kellett 2007; Grant 2009). Such organisations are continuously lobbying and garnering media attention on the need for urban fringe growth to combat the so-called 'housing affordability crisis'.

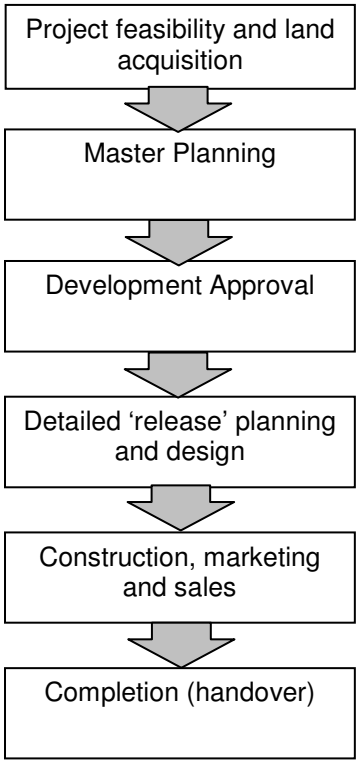
There is considerable diversity in the residential estate development sector, making it difficult to establish a typical process of development delivery (Coiacetto 2007b). Within the MPE development sector, though, it is possible to identify a consistent process, accepting that the detail underpinning such a process will change on a case by case basis. Bajracharya et al. (2007) identify three critical stages in the development of MPEs:

- Visioning and planning stage
- Implementation stage (approval, construction, marketing)
- Completion stage (handover to local council management)

This three stage summary provides a useful framework with which to consider MPE development, but in order to reveal key phases in the development delivery process where actions can be taken to effect sustainable outcomes, it is necessary to provide further articulation. Examples from industry (VicUrban 2006; Delfin Lend Lease in Bajracharya et al. 2007) highlight the importance of a preliminary project selection and feasibility assessment stage. The objective of this stage is to determine the viability of a potential project, leading to land acquisition and organisational commitment to the planning and design process. Also critical is the planning approval stage, where planning approval bodies have the ability to influence the development outcomes (Carter 1990). While planning approval processes are subject to significant variation across jurisdictions, approval will typically involve an approval process for the overall

master plan and, for large developments, a series of approval processes as stages of the MPE are released (Dowling and McGuirk 2005a). Figure 3 thus provides a high level summary of the key stages in the delivery of MPEs.

Figure 3 – Stages of MPE delivery.



2.5 Sustainability and Master Planned Estates

While the discourse on sustainability, and its implications for urban development, is examined in detail in Chapters 3 and 4, a brief review of the treatment of sustainability in the delivery of MPEs is provided below to demonstrate the connectivity between MPE development and broader sustainability concepts. In the burgeoning literature on MPEs in Australia, discussed previously, there is scant attention paid to notions of ecological sustainability, or even to broader conceptions of sustainability, in the delivery of MPEs (limited coverage from Blair et al. 2003; Yigitcanlar et al. 2007; and Rosenblatt et al. 2009). This gap is particularly significant given the growing prevalence of sustainability rhetoric in practical literature and communication materials

surrounding MPEs, as developers seek to keep pace with evolving community and political expectations.

In Australia, one of the earliest MPEs to embrace concepts of sustainability was the Laurimar Estate on Melbourne's northern fringe, developed by Drapac Property. The development actively promoted a development "philosophy" based on the developers' interpretation of the three pillars of sustainability (discussed in Chapter 3) of Nature, What we Build, and People, stating that "[the] three pillars extend beyond environmentally sustainable development to encompass comprehensively sustainable development" (Drapac and Danvers 2005). Michael Drapac's vision for Laurimar was ultimately unfulfilled, with the development taken over by Delfin Lend Lease in 2006. While Delfin Lend Lease abandoned much of the sustainability rhetoric of the Laurimar development, they have nonetheless been prominently involved in other urban development projects that engage with sustainability. Their Mawson Lakes development in Adelaide was one of the first in Australia to implement large scale water recycling and the redistribution of recycled water back to residential properties, and sustainability is invoked as a key motivating principle behind the development (Delfin 2005). In an attempt to quantify the environmental impact of the many initiatives implemented at Mawson Lakes, an ecological footprint analysis was undertaken, which found a 20% reduction in impact compared to surrounding urban development (Delfin Lend Lease 2010).

The state government land development agencies identified above have also been keen to incorporate sustainability into their urban development projects. Seville Grove, a development of Landcorp, the West Australian land development agency, presents itself as "a model sustainable community", with "[a] sustainability audit" process to ensure all homes "achieve a five-star plus energy rating; install a 2,500 litre rainwater tank plumbed to washing machines and toilets; [and] plant gardens with at least 50% waterwise species" (Landcorp n.d.). VicUrban in Victoria developed a Sustainability Charter to direct its development practice (VicUrban 2006), and has lauded its Aurora development as a new benchmark in sustainability (VicUrban 2004). The Charter was set up as an evaluation tool for VicUrban, but was always envisioned as a precursor to a

broader industry relevant tool. In addition, both Landcom in New South Wales, and the Land Management Corporation (LMC) in South Australia have engaged significantly with sustainability. LMC has utilised ecological footprint methodology to evaluate development performance (Blaess et al. 2007), while Landcom has produced a sustainability checklist to articulate sustainability in its urban development projects (Landcom 2009a) and, more recently, have been developing a more comprehensive assessment tool called PRECINX (Landcom 2009b).

Another subset of MPE development embracing the sustainability theme is the semi-rural 'ecovillage' development, such as the SomerVille ecovillage on the outskirts of Perth, which seeks to become a "world leading example of sustainable development" (Antonelli 2003). In the rapidly growing pockets of South East Queensland and northern New South Wales, the Ecovillage at Currumbin and Mebbin Springs respectively, present alternative lifestyles to conventional urban development, with Mebbin Springs marketing itself as a "fully sustainable … community" (Advertisement – *The Australian*, Friday 2 March 2007 p30); and the Ecovillage at Currumbin (2010) aiming to "create a community that will have as its core – Living Sustainably". To add legitimacy to these claims, both Mebbin Springs and the Currumbin Ecovillage have sought certification with EnviroDevelopment, a sustainability standard for assessing the performance of urban development, with both achieving the highest level of certification possible (UDIA 2010a).

These examples illustrate the increasing use of sustainability by developers to frame their operations and their MPE developments. There is, however, a great variance in the practical measures that underpin such marketing claims of sustainability, ranging from the relatively modest achievements of Seville Grove (their goal of meeting a 5-star home energy efficiency rating, for example, is the minimum allowable in other jurisdictions in Australia) to the Ecovillage at Currumbin, with a long list of technical resource efficiency actions, community facilities, and ecological protection measures. Perhaps as a result of this variance, developers of MPEs that identify with sustainable development are increasingly engaging with mechanisms such as certification or performance evaluation to add legitimacy to their claims. Yet within this field of

certification and evaluation, there is a wide range of approaches, and a lack of critical literature examining the efficacy of such tools, or the consistency and transferability between different approaches.

Certification and evaluation tools are increasingly driving the nature of MPE developers' engagements with sustainability, thereby acting as a means of operationalising sustainability concepts as well as a way of legitimising claims to sustainability. In the absence of regulatory mechanisms to achieve sustainability outcomes in estate development, such assessment mechanisms can be considered key techniques for intervening in the planning and development process in order to bring about change. The current lack of consistency and lack of critical evaluation of such mechanisms, however, raises serious questions regarding their effectiveness in improving the sustainability of MPE development.

2.6 Implications for Research

It is clear that urban fringe development will continue to play a key role in the growth of Australian cities, if not remain the predominant focus. Given the significant environmental impact of this type of development, it follows that the form and function of our cities – particularly new growth areas – must change if urban sustainability is to be achieved, or even attempted. Therefore critical research attention to the performance of such development is vital. Greenfield sites present the opportunity to either respond proactively to these challenges or to further entrench unsustainable patterns of living.

Recent urban planning policy in Australia reflects sustainability rhetoric; however evidence to date suggests that the transfer of policy principles into changed development practice on the urban fringe has been ineffectual. Limited government regulation and a trend in recent times for flexible performance-based planning policy has meant that aspirational targets for improved urban sustainability have not affected implementation on the ground. This highlights the conflict between neoliberal and interventionist approaches to urban planning and development, leading to calls for 'after neo-liberal' approaches based on increased certainty via stronger regulation to achieve desired outcomes.

The MPE, because of its proliferation, size, and single developer control is increasingly the functional unit of urban fringe growth in Australia. MPEs are also increasingly engaging with concepts of sustainability to meet changing consumer and political sentiment, and to legitimise and guide future direction. There is a gap in critical evaluation of this engagement, and in particular of the emerging sustainability assessment and accreditation tools operating in this space. Such assessment and decision-making approaches have emerged as the primary methods for implementing sustainability in the MPE scale of development. It is critical therefore that such tools are scrutinized to ensure that their claims to sustainability are valid and based on a solid foundation of recognised sustainability principles. The next chapter provides a detailed examination of sustainability and sustainable urbanism discourse, in order to establish a basis for the critical evaluation of sustainability assessment tools to follow.

Chapter 3: Sustainability

Introduction

Debates regarding the future of cities are now almost always framed by the rhetoric of sustainability and sustainable development. As identified in Chapter 2, these concepts are increasingly being invoked to guide the evolution of greenfield development and to legitimise its place in the future of cities. At first glance, the process of urban fringe development – where biodiverse and bioproductive land is subsumed to create low density, largely car dependent suburbs – seems incongruous with the principles of sustainability, particularly with regard to the impact of human activities on ecological systems. However, sustainability and sustainable development are contentious and contested concepts. For such widely used and pervasive terms, there is a striking absence of definitional clarity or consistency in their use. An understanding of the genesis of these concepts, and the present and likely future of the debates surrounding them, is therefore critical in underpinning any attempt to evaluate the operationalisation of sustainability principles in an urban development setting. This chapter turns its attention to these issues, prior to an in-depth look at sustainability assessment in Chapter 4. It begins with a review of the origins and development of sustainability concepts and inherent principles, before discussing contemporary sustainability debates. Through a review of the literature, it demonstrates the complexity and ambiguity in conceptualisations of sustainability, and the contested nature of contemporary debates regarding theory and practice. Narrowing the focus of this discussion to urban development, the chapter then concludes with a review of conceptual approaches to the application of sustainability principles in cities and suburbs.

3.1 Origins and Principles

The rise of sustainability

The modern concepts of sustainability and sustainable development have evolved rapidly to become the central unifying themes of the discourse on human development. At the core of the concept of sustainability is the relationship between humans and the

environment, with a recognition of humankind's dependence on the Earth (Low et al. 2005). This, of course, is not a modern phenomenon. Studies of human histories reveal countless ways in which dependence on the ecological systems was recognised and acknowledged. Boyden and Dovers (1997), for example, provide a detailed account of humankind's evolving relationship with the environment, categorising ecological phases of human history as the hunter-gatherer phase, early farmer phase, early urban phase, and the modern high-energy phase. These phases of human development correspond with changes in the nature, or perceived nature, of the human-environment relationship. The hunter-gatherer phase is characterised by humankind's total dependence on the natural environment for the provision of all forms of food and shelter. Evolving human ingenuity and technological development resulted in tools and processes to make this relationship with the environment more efficient, culminating with the agricultural revolution. This marks the first significant phase in the perceived taming of the natural environment, where humankind began to assume ownership of plants and animals. The early urban phase sees the beginning of permanent and centralised human settlement, providing the ability to store and protect food surpluses. This protection from the changeability of environmental conditions created a further degree of perceived independence from the Earth as provider. Urban settlement also enabled the beginning of cultural separation from the surrounding environment, with surplus food allowing the pursuit of other activities, and the beginning of specialised professions (Kostof 1991).

The industrial revolution marks a key point in the modern history of the human-environment relationship, with the "dramatic switch" from organic materials and energy sources to harnessing the huge energy potential of fossil fuels (White 2001:50), beginning the transition to the modern high-energy phase in the human-environment relationship. This seemingly endless supply of energy fuelled a rapid industrialisation of production processes, resulting in a massive increase in resource consumption and waste production, ushering in what White describes as a new era of human-led destruction of the biosphere. In parallel, scientific enlightenment established an era of human knowledge and mastery of nature, signifying a diminished sense of reliance on the Earth for survival (O'Connor 1993). As the localised ills of the industrial revolution were progressively cleaned up throughout the late nineteenth and twentieth century, "the

relationship between people and the environment was conceived as humanity's triumph over nature" with the prevailing belief that "human knowledge and technology could overcome all obstacles including natural and environmental ones" (Hopwood et al. 2005:38). This technological optimism, coupled with mass production, gave rise to a culture of mass consumerism, with continued economic growth through increasing production and consumption being seen as essential to the well-being of humanity (Hopwood et al. 2005).

This perception of mastery of nature provides the context for the dissenting voices of the late nineteenth and early twentieth centuries such as Malthus (1973), Engels (1969), Leopold (1949), and Pigou (1932) that constituted the genesis of the modern environmental movement and, with it, the concept of sustainability. After World War II, with economies booming, the dissenting voices began to gather momentum. Rachel Carson's seminal work *Silent Spring* (1962), which highlights the ecological impacts of industrial development, is often credited with laying the foundations of modern environmentalism (Diesendorf 1997; Rao 2000). The sustainability debate rapidly gathered pace in the 1970s and 1980s, spurred on by the 1973 Oil Crisis, and key publications and events such as *Limits to Growth* (Meadows et al. 1972); the 1972 United Nations Conference on the Human Environment; and the *World Conservation Strategy* (IUCN, UNED and WWF 1980). Increasingly, concerns around global environmental issues such as species extinction, ozone depletion, resource depletion, and GHG emissions, were entering the mainstream consciousness.

The drastic predictions made in *Limits to Growth* (Meadows et al. 1972) challenged the notion that continued economic growth would deliver continued human development. In analysing future growth trends, Meadows et al. argued that the current development path, if continued, would reach its limits in the next one hundred years, resulting in catastrophe for the human race. They proposed an alternative development path that would be sustainable far into the future, and argued that the sooner humanity starts down this path, the more likely it is that catastrophic consequences will be avoided. The report received a hostile response from mainstream economists, and was widely criticised as overly pessimistic in the Malthusian tradition, with a failure to recognise

the beneficial impacts of technological progress (Diesendorf 1997). However, along with *Blueprint for Survival* (*The Ecologist* 1972) and the 1972 United Nations Conference on the Human Environment, it is credited with popularising the notion of sustainable development (Rao 2000; Finco and Nijkamp 2001). The 1972 United Nations Conference, in particular, brought broader exposure and political support to the concept of sustainability as a means for exploring alternatives to the existing development path, and resulted in the establishment of the United Nations Environment Programme.

The 1980 release of the *World Conservation Strategy*, subtitled 'Living Resource Conservation for Sustainable Development', popularised the concept of sustainable development in international discussion and is often cited as the first occasion that the term 'sustainable development' is explicitly used and defined (Hopwood et al. 2005). The report has a strong focus on environmental conservation, stressing the importance of development within limits of the carrying capacity of ecosystems (Mitlin 1992); with the concept of sustainable development used to denote approaches that safeguard the long-term productivity of renewable resources (Hueting and Reijnders 2004). Sustainable development thus emerged as a means for defining development paths that deliver on the principles and goals of sustainability (Disendorf 2000)

The tipping point for sustainability discourse came with the release of *Our Common Future* (WCED 1987), and the follow up United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro in 1992 (Sneddon et al. 2006). These two events solidified sustainability as a defining societal issue; and sustainable development as the practical means for reconciling ecological protection with human development needs. Our Common Future is the report of the World Commission on Environment and Development, commonly called the Brundtland Report after Gro Harlem Brundtland, the Commission's chair. It is arguably the most important document in the evolution of the concept of sustainable development. The Report was the result of a five-year process of inquiry, and has since set the scene for the sustainable development debate. The much-quoted definition of sustainable development provided in the Report is "...development that meets the needs of the

present without compromising the ability of future generations to meet their own needs" (WCED 1987:87).

This definition is often criticised for being vague and ambiguous (Lélé 1991; Luke 2005). However, the Report presents much detailed clarification of meaning, elements often left out of consideration by those purporting to follow the Brundtland approach. Directly following the above quote, the Report provides two important clarifiers that are vital to understanding the meaning and purpose of sustainable development (Langhelle 2000). The Report states that sustainable development is comprised of two key concepts:

- the concept of 'needs' in particular the essential needs of the world's poor, to which overriding priority should be given, and
- the idea of limitations imposed by the state of technology and social organisation on the environment's ability to meet present and future needs (WCED 1987:87).

The Brundtland Report goes on to provide further clarification of these concepts (WCED 1987:88-90) and then defines sustainable development as "a process of change" (WCED 1987: 90) rather than an end goal or destination (Brandon and Lombardi 2005). Importantly, this change has clear objectives and constraints. First, it is change that meets *needs*, which is clearly focused on improving the conditions of the world's poor and disadvantaged. Second, it is change within *limits*, such that future generations are not compromised.

The Brundtland Report clearly broadened the concept of sustainable development from previous approaches such as *The World Conservation Strategy*, introducing a strong focus on economic growth as a key element of development as opposed to earlier associations with steady state economies (Hueting and Reijnders 2004). It still, however, challenged the dominant growth paradigm, calling for a different form of growth: one with an emphasis on human development and equity and a recognition of humanity's dependence on the environment and the interconnectedness of environmental systems (Satterthwaite 1997; Hopwood et al. 2005). The Brundtland Report is widely recognised as bringing the concept of sustainable development into the mainstream and providing it with official credibility (Mitlin 1992; McManus 1996). Since its publication, the influence of the Brundtland Report on mainstream policy

thinking has resulted in its approach to sustainable development being widely accepted as *the* approach to sustainable development.

Despite the elevation of ecological issues provided by the Brundtland Report, it has been criticised in environmental fields (see McManus 1996; Wackernagel and Rees 1996; Hueting and Reijnders 2004), with the most common issues raised being an overly anthropocentric focus; a reliance on the ambiguous concept of needs; a bias toward the interests of developed countries; and a tacit acceptance of the desirability of traditional economic growth. The Report's overt focus on economic growth as an imperative was particularly criticised for diminishing the importance of maintaining ecological systems and for lacking robust recognition of ecological limits (Wackernagel and Rees 1996). As such, the Brundtland Report effectively popularised a "green capitalism" approach to sustainable development, an approach that McManus (1996:48) argues "became the accepted wisdom" on the integration of economic and environmental issues, and as a result "contributed to the marginalisation of previous discourses on sustainability".

UNCED, held in Rio de Janeiro in 1992, was the first major post-Brundtland event to focus on the implementation of sustainable development, involving broad participation by governmental officials, with 100 heads of state attending and 179 national governments participating (Brandon and Lombardi 2005). In terms of progressing the sustainable development agenda, two key outcomes of the Rio Conference were the Rio Declaration on Environment and Development, and Agenda 21 (UNSD 1992). Agenda 21 is a 40 chapter non-binding action plan that builds on the principles of sustainability. It marked a significant turn in the debate, with its broad agenda for change helping to clarify sustainable development as a functional action plan (Devuyst 2001). However, as a non-legally binding document it has had limited effectiveness in implementation (Rao 2000).

Principles of sustainability

The Rio Declaration on Environment and Development began the discussion and development of fundamental principles of sustainability which have become the subject

of considerable debate in the years since. The Rio Declaration consists of 27 principles or statements. Many of the principles are in fact strategies, such as the development of effective environmental legislation (principle 11) or the use of Environmental Impact Assessment (principle 17), while others relate particularly to the role of nation states. However, there are several key principles in this list which are widely considered to form the foundations of the concepts of sustainability and sustainable development – those of inter-generational equity, intra-generational equity, and the precautionary principle (see Diesendorf 1997; George 1999; Gibson 2000; Devuyst 2001).

The principle of inter-generational equity states that development must meet the environmental needs of present *and* future generations (Rio principle 3). It demands that the quality of life we create for society now must be able to be sustained, so as to be available for future generations. As such, it can be regarded as the 'sustainability' component of sustainable development (George 1999). It recognises the essential role that ecological systems play in supporting life; that these systems have limited regenerative (sustainable) capacity; and that therefore ecosystems must be protected and restored to ensure their ongoing viability (UNSD 1992; Wackernagel and Rees 1996; Low and Gleeson 2005). In the language of ecological economics, it is about not overdrawing on natural capital for the benefit of current generations, at the cost of future generations (Hawken et al. 1999). The need to protect and restore the health and integrity of the Earth's ecosystems in clearly communicated in the Rio principles as a means of satisfying inter-generational equity (principles 4 and 7).

The principle of intra-generational equity states that eradicating poverty is an indispensable requirement for sustainable development (principle 5), making it clear that sustainable development is human-centred (principle 1), and fundamentally concerned with improving the well-being of the world's poor, and providing for a more equitable existence between current generations (principle 6). Intra-generational equity, therefore, refers to equity in well-being (or quality of life) *within* generations, and is about the human development side of sustainable development (George 1999). George (1999:178) argues that sustainable development can be completely defined by the combined application of inter-generational equity and intra-generational equity:

> Inter-generational equity is a necessary condition for sustainability. Intra-generational equity is a necessary condition for development, in the form which was envisaged by the [Stockholm and Rio] conferences and the [Brundtland] commission (1999:178).

Sustainable development is therefore a particular kind of development – one that seeks to improve equity and well-being, while sustaining the Earth's ecological systems.

In a similar vein to Agenda 21 and George's (1999) analysis of sustainable development principles, Wackernagel and Yount (2000:22) present sustainability as being made up of two imperatives: the "socio-economic imperative", requiring "an adequate quality of life for people all over the world"; and the "ecological imperative", ensuring that providing quality of life "must not be done at the expense of using the Earth's bioproductive capacity beyond its ability to regenerate". The ecological imperative thus correlates with the principle of inter-generational equity, with its focus on the protection and restoration of ecological systems to ensure that development can meet the needs of present *and* future generations, while the socio-economic imperative correlates with intra-generational equity, with its focus on equity in well-being *within* generations.

The precautionary principle states that "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation" (principle 15) (UNSD 1992). It aims to avoid detrimental impacts on ecological systems as a result of development, by considering potential threats in decision-making and approval processes (Harding and Fisher 1999). In a challenge to 'business as usual' approaches, it requires that the proponents of development take ownership of risk and uncertainty with respect to potential ecological impacts, shifting the onus of proof from government or concerned third parties to those proposing development. It therefore effectively further mediates the 'human development' dimension of sustainable development, recognising the potential conflict between development and the maintenance of ecological systems.

Since the Rio declaration there have been a number of key international events which have discussed the concept and principles of sustainability and sustainable development,

such as the second United Nations Conference on Human Settlements (Habitat II) held in Istanbul in 1996, and the World Summit on Sustainable Development in Johannesburg in 2002. However, these have not had the same impact on sustainability discourse as previous landmark events, as their commentary tends to have been dwarfed by the sheer enormity of discussion, research and literature that is now being produced in this field. A short period after Brundtland, Lélé (1991:607) observed that sustainable development "has become the watchword for international aid agencies, the jargon of development planners, the theme of conferences and learned papers, and the slogan of developmental and environmental activists" and predicted that the term "is poised to become the developmental paradigm of the 1990s". Lélé's forecast proved correct, and in the years since the Rio Declaration there has been an explosion of academic, government and corporate literature on sustainable development.

Sustainability is now firmly on the agenda as a national and international policy issue (Sneddon et al. 2006). The use of the concepts of sustainability and sustainable development is broad and deep, influencing and often defining contemporary policy debates, strategy development and reporting. References to these concepts can be found throughout government policy, conference titles, corporate plans, and annual reports; in the titles of academic research centres, advocacy groups, and think tanks; and increasingly in the commercial world as an attribute of products and services (Low et al. 2005). Indeed, as Finco and Nijkamp observe, "sustainable development – both globally and locally – has become the dominant policy paradigm" (2001:293).

The scale of influence of sustainability discourse can be seen to represent a significant shift in the understanding of the human-environment relationship, away from the dominant paradigm of the last few centuries which saw the environment as a source of resources separate to the human world, to a greater understanding of our reliance on the environment, and of the need for natural systems to be sustained for human survival (Hopwood et al. 2005; Low et al. 2005).

3.2 Contemporary Debates

Mapping a contested concept

While it is clear that sustainability is now the defining concept in discourses relating to the human-environment relationship its meaning is far from universally agreed upon. Within discourse and practice there are many differing approaches, sometimes synergistic, but often conflicting. There exists an amorphous field of debate, with varied understandings of meaning, principles and application, as well as distinct political and disciplinary approaches which can often be contradictory, or at the very least offer significant differences in emphasis. The following section presents a discussion of these approaches, highlighting key areas of contention. Key definitional elements and principles which will be drawn on to inform this research are then identified. Fundamental to this discussion is an acknowledgement of the contested, subjective and often ideologically informed nature of sustainability debates.

The Brundtland definition of sustainable development is by far the most commonly used and quoted. It is also regularly used as the starting point for others to create modified definitions: definitions that are seen to better meet an organisation's particular practical (or political) focus. However, since the release of the Brundtland report there has been a plethora of variations in the definition of sustainable development which subtly change emphasis and meaning. Mawhinney (2002:5), for example, presents 17 varying definitions of sustainable development from significant sources to illustrate the diversity of approaches, highlighting common themes, but also pointing out problematic differences, concluding that "sustainable development appears to be an over-used, misunderstood phrase".

Many authors have analysed the diversity in approaches to sustainability, and there exist several well-researched typologies, mappings and analyses of approaches to sustainability and sustainable development (Dobson 1996; McManus 1996; Wackernagel and Rees 1996; Spangenburg 2004; Connelly 2007). A common method of analysis is a spectrum approach which locates the varying positions taken on sustainability on a linear scale, typically between weak and strong poles (Connelly,

2007). This method generally sees traditional economists, advocating the retention of the current economic system as the primary framework for progressing humanity, placed at one end of the spectrum; and environmentalists, advocating reform or transformation of systems to focus on environmental and resource protection, at the other (Mawhinney, 2002). These simple linear spectrums clearly demonstrate the political and ideological dimensions of sustainability.

The weak-strong classification first originated out of the ecological economics movement (Wackernagel and Rees 1996). Ecological economics is an attempt to use the accepted rules and conventions of economics, via a broader understanding of assets and capital, to internalise environmental and social impacts as costs in an economic analysis. In this economic conceptualisation, "weak sustainability" defines a sustainable society as one where the aggregated stocks of manufactured and natural assets is not decreasing. This definition allows for the conversion of natural capital to human capital (through manufacturing) without considering it a depletion of overall capital. "Strong sustainability", on the other hand, argues for the recognition of "the unaccounted ecological services and life-support functions performed by many forms of natural capital and the considerable risk associated with their irreversible loss" (Wackernagel and Rees 1996:37). Strong sustainability therefore requires that natural capital stocks are maintained independently of human capital stocks.

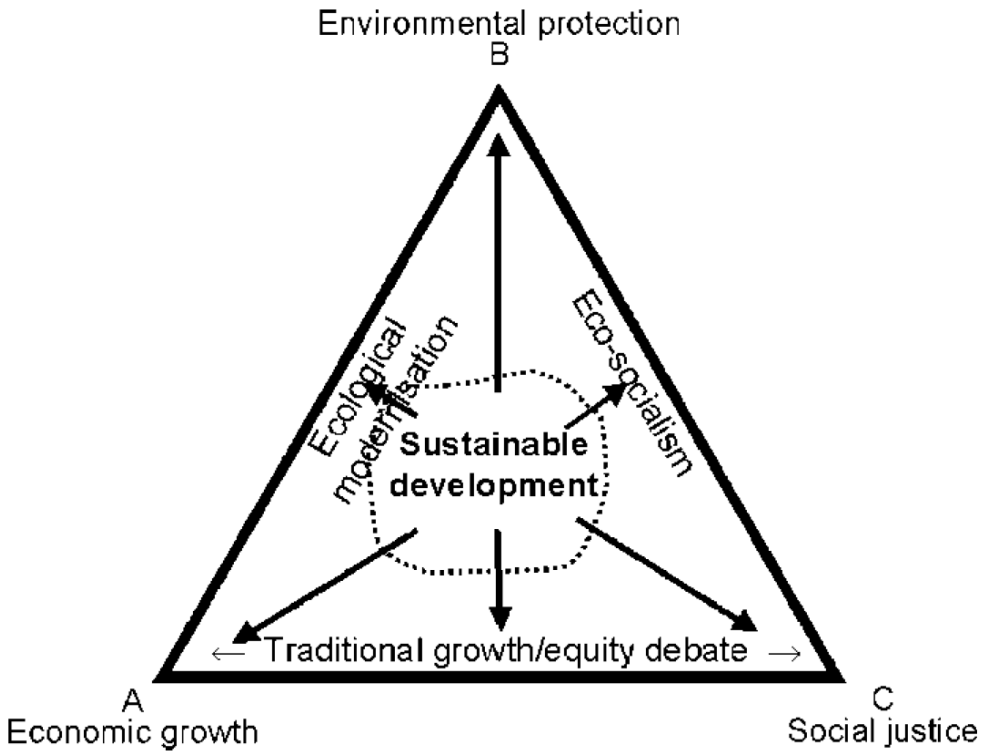
This weak-strong analysis can also be set within an ideological framework, commonly presented with deep ecology at the very-strong end, and free market environmentalists at the very-weak end (Finco and Nijkamp 2001). Other variations include pitting conservation approaches against technological optimism (see Brandon and Lombardi 2005); pessimist versus optimist; left-wing versus right-wing; and human-centred versus nature-centred (Mawhinney, 2002). The strength of these linear typologies is that they facilitate comparison between differing approaches by locating them together with other approaches on an issue scale. They also starkly reveal the degree to which ideological position can influence the interpretation of sustainability.

While the linear typologies can effectively communicate the ideological position of groups between two poles, they are inherently focused on the definitions of those two poles. They therefore oversimplify the diversity within sustainability discourse, frequently conflating often conflicting standpoints onto the one-dimensional typology (Mawhinney 2002; Hopwood et al. 2005; Connelly 2007). Strong positions typically combine ecological and social priorities and place them together in opposition to traditional economic development, while weak positions frequently combine techno-centric and economic status quo viewpoints. While synergies between such viewpoints are common, they do not always exist. As an example, Connelly (2007) highlights the potentially conflicting perspectives of proponents of deep ecology on the one hand, and social equity advocates on the other, where a socially formed consensus may not align with an expert driven assessment of environmental priorities.

Broader typological classifications also exist that categorise approaches rather than locating them on a linear spectrum (see Dobson 1996; McManus 1996). McManus (1996), for example, following an extensive review of the literature, suggests that approaches to sustainability fall into one of nine groups: the Brundtland approach; free-market environmentalism; market interventionism; steady-state theory; smaller-scale advocacy; eco-feminism; eco-Marxism; 'mirror nature'; and the constant natural capital stocks criterion. While not intended to be rigid, or to represent clearly defined boundaries, McManus argues that these nine groups encompass the main differing positions on sustainability.

In order to compare differing approaches with a greater degree of sophistication, some authors have attempted to map approaches to sustainability and sustainable development on multi-dimensional fields. Connelly presents an alternative approach to mapping contested notions of sustainable development, "in a way that unpacks the ambiguities and tensions, rather than attempting to either suppress or oversimplify them". He proposes a continuous field "on which *any* solution to the environment and development problem can be located – including those which will count as sustainable development, but extending well beyond these" (2007:268) (Figure 4).

Figure 4 – Connelly's mapping of sustainable development.

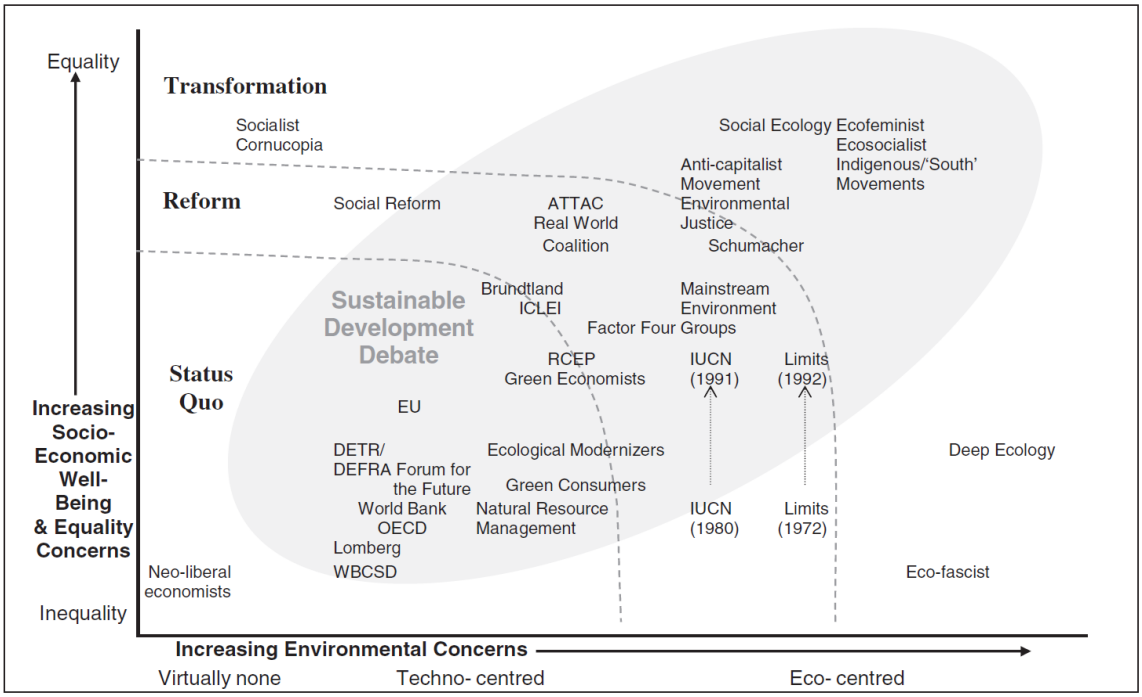


(Connelly 2007)

In Connelly's field, the corners and sides represent extreme viewpoints, with sustainable development occupying the central region of the field, representing a balance between extreme positions through either integration or trading-off between principles and outcomes. Reflecting the ambiguous nature of sustainable development, the inner region can contain a range of positions corresponding to differing interpretations of priorities, with the boundary of the inner region left undefined as it is inherently subjective. Connelly presents the framework, therefore, not as an absolute mapping, but a useful heuristic device for examining the relationships of approaches to sustainable development that other typological approaches tend to obscure, providing the ability to map all contested development trajectories. It thereby

> provides a classificatory tool through which the relationships between different policies, programmes or impacts can be assessed, without artificially bracketing off some as embodying an objectively sustainable development and others not (Connelly 2007:274).

Figure 5 – Mapping of views on sustainable development.



(Hopwood et al. 2005)

Like Connelly, Hopwood et al. (2005) developed a mapping methodology to present the varying approaches to sustainable development in relation to each other, and the principles they relate to (Figure 5). It is presented as a broad conceptual framework rather than a precise mapping, with the authors acknowledging that the nature and location of the boundaries, and the situating of approaches within these boundaries, are open to debate and challenge. The field visually demonstrates the diversity of views, and reveals the authors' argument that more radical transformative approaches are needed, with reform approaches acting as a bridge to transformative approaches (Hopwood et al. 2005). They argue that status quo approaches dominate policy, characterised by "top-down and incremental" approaches in "existing structures of decision-making" (2005:48); and that these are used to justify business as usual, and as such are inadequate to meet the needs of sustainable development.

Seeking definitional clarity

The various mapping methodologies outlined above are responses to the significant diversity in interpretations of sustainability and sustainable development that now exist.

They attempt to sort and make sense of this variety of positions. To a large degree, the marked differences between approaches can be attributed to the fact that, at their core, they are based on differing understandings of the principles and goals of sustainability, and differing approaches to sustainable development as a means to deliver on these goals and principles. What is required, then, is a greater degree of definitional clarity. This is attempted by several authors (see Lélé 1991; Sutton 2004; Wheeler 2004; Brandon and Lombardi 2005) who examine the variation in definitions of sustainability and sustainable development by beginning with a discussion of basic definitional terms, with the aim of establishing a point of common understanding. Sutton (2004), for example, reminds us that in basic terms, sustainability is the ability or capability to sustain something; to maintain it through time. To develop, on the other hand, is to improve, change, grow, or move to a more advanced state. Therefore, at a fundamental level, "sustainability is about *continuity* and development is about *change"* (Sutton 2004:8). Sustainable development is therefore a particular type of development, with the objective of improving upon the existing situation, while not damaging the things we want to sustain. Given this, the appeal of the concept is evident: at its simplest, sustainable development is about changing the things we need to change and sustaining the things we need to sustain (Lélé 1991; Sutton 2004; Low and Gleeson 2005). The challenge arises in defining what to sustain, and what to develop; and more critically, how the conflicts between the desire to sustain and the desire to develop are resolved. Embedded in these simple directives is much complexity and ambiguity. What must be sustained and for whom? What constitutes sustaining? What needs to change? And, most critically, how are conflicts between the desire to sustain and the desire to develop resolved? Should the emphasis be on *sustainable*, with efforts focused on "ecological and social transformation", or should it be on *development*, interpreted as "more sensitive growth" under a "reformed version of the status quo" (Wackernagel and Rees 1996:33)?

There can be both meaningful and trivial responses to this challenge. A literal interpretation of the concept of sustainability could result in an attempt to sustain anything, or everything. Indeed, there is evidence of the tendency for sustainable development to be used to justify the need for "sustaining economic growth" or

"sustaining certain industries" (Diesendorf 1997:71), with its meaning dissolved to become merely a synonym for *successful* development (Lélé 1991). These drifts in meaning represent trivial responses to sustainability because they ignore the basic premise of maintaining ecological systems to support human life. The principles of inter-generational and intra-generational equity do not refer to, or require, the sustaining of economic systems, or sustained economic growth. Indeed, current economic systems for distributing wealth and for valuing ecological services are responsible for vast inequities in human well-being and widespread ecological degradation (Marcuse 1998).

Many authors (see Lélé 1991; Dobson 1996; Sutton 2004; Low and Gleeson 2005) prefer the term *ecological* or *environmental sustainability* over *sustainability*, arguing they give greater definitional clarity. This need for precision is prompted by the increasing use of terms such as *social sustainability*, *economic sustainability*, and *business sustainability*, and the slippage of meaning in interpretations of sustainable development, such that it becomes merely 'status quo development', as highlighted above. The term *ecological* helps to clarify what is being sustained – that the focus of sustainability is on ecological systems, as opposed to *development* which is focused on improving social conditions. Thus *ecologically sustainable development* is put forward as a more precise term than *sustainable development*, and one less likely to cause confusion or suffer from corruption of meaning. The term *ecologically sustainable development* has been particularly prominent in Australia, with an institutionalisation of the term via the 1992 National Strategy for Ecologically Sustainable Development (Government of Australia 1992).

It is apparent that the contention around definitions of sustainability and sustainable development is founded as much on politics and ideology as it is on differing understandings of the human-environment relationship. The concept of sustainability can be seen as being made up of *system* components able to be objectively understood, and *value* components based on principles that need to be politically negotiated (Hodge 1997; Mawhinney 2002). Sustainability appeals in part to objectivity, to a scientific understanding of physical, ecological systems and a quantification of the human impact on these systems. It also appeals in part to hitherto unknown physical needs, through the

precautionary principle. In addition to these appeals to objective science, sustainability has strong value-based components embodied in concepts such as equity and social development. This positions sustainability and sustainable development as socially constructed concepts, built on social norms and values regarding how humanity should relate to, and utilise, natural systems. As such, approaches are invariably infused with politics, ideology, and agendas, despite frequent appeals in policy discourse to scientific objectivity (Redclift 2005; Gunder and Hillier 2009).

Lélé (1991) argues that the vagueness in many of these approaches to sustainability is a reflection of politics and ideology, rather than a lack of intellectual capacity or understanding of the human-environment relationship. The problem with such vagueness and ambiguity of meaning is that sustainability rhetoric can become a "cloak for environmentally and socially undesirable policies" (Connelly 2007:259), allowing "business and governments to be in favour of sustainability without any fundamental challenge to their present course" (Hopwood et al. 2005:40). However Walker and Shove (2007:216) argue this "vagueness, ambiguity and ambivalence can be seen as [a] strength rather than [a] weakness", highlighting that the concept of sustainability evolved as a deliberate means to challenge dominant development paradigms. For Walker and Shove it is the continued struggle over the contested nature of such concepts that facilitates reflexive examination of societal goals and norms.

Sustainability – a workable concept?

The growing breadth of use of the concepts of sustainability and sustainable development, along with concerns for their misuse, has led many to question their effectiveness or relevance in engaging with the challenges posed by human-environment relationships. It seems that while the principles of sustainability are widely endorsed, they are wholeheartedly underachieved and, as such, sustainability has not successfully delivered the integrative agenda it espouses (Dovers 2007). Responding to the growing breadth in the use of sustainability, Low and Gleeson have provocatively suggested that "if sustainability is everything, maybe it's nothing" (2005:1), invoking Wildavsky's (1973) famous challenge to urban planning in his paper "if planning is everything, maybe it's nothing". The suggestion is that the trend towards

an all-encompassing interpretation of sustainability has resulted in the concept losing critical meaning. Campbell (1996:301) summarises this view of sustainability as being "stripped of its transformative power and reduced to its lowest common denominator … it is so malleable as to mean many things to many people without requiring commitment to any specific policies". To Marcuse (1998:111), the malleability inherent in the "slogan of sustainability" effectively "suggests that there are policies that are of universal benefit, that everyone, every group, every interest will or should or must accept in their own best interests"; a belief that obscures the complexity and conflict entailed in achieving a "just, human and environmentally sensitive world", thereby undermining real reform.

McManus (1996) is critical of what he sees as a shift in the dominant discourse of sustainability from a transformative concept towards a repackaging of the status quo. He argues that the concept of sustainability has been "marginalised and steered into the safe waters of sustainable development, large conferences, quantification and technological experts" (1996:69), with dominant discourse "limited to the global management of contemporary capitalism in a 'green framework'" (1996:70). Luke (2005) goes further, arguing that sustainable development was and always will be an ideological construct that reinforces status quo market-led capitalism. To Luke (2005:232) the concept "boils down to a new form of economic rationality" where businesses that "prevent pollution, reduce waste and maximise energy efficiencies" are "supported as world-remaking programs", where in reality they are simply "reaffirm[ing] most existing premises of technology utilization, managerial centralization and profit generation now driving advanced corporate capitalism". More recently Gunder and Hillier (2009:141) have argued that sustainability has become a "master signifier" – a concept with inherent malleability and ambiguity, one that "everyone purports to understand … but somehow they find it very difficult to represent in concrete terms".

In the face of such critique, the continued utilisation of the concepts of sustainability and sustainable development to achieve improved ecological and social outcomes must be questioned. Are they doing more harm than good? While some, such as Luke

(2005), argue for their abandonment, most who question their effectiveness call for greater critical attention and greater integrity in application. McManus, for example, (1996:70) calls for a re-focusing of our conceptualisation of sustainability, demanding understandings that "lead to 'ecologically meaningful' approaches to sustainability". Gunder and Hillier (2009) are sympathetic to Luke's decree on sustainability but, like McManus, argue that the challenge is to

> re-articulate sustainability's core concern, not as a mechanism for justification for more pro-market behaviours, but as a means to displace the economic imperative from its throne of supremacy over that of social equity, cultural appreciation and the environment (2009:154).

Marcuse (1998) also argues for a deliberate narrowing of the scope of sustainability to ecological issues, though his concern is based more on maintaining the integrity of the concept of social justice, which he sees as being eroded by the expanding reach of sustainability:

> We should rescue sustainability as an honourable, indeed critically important, goal for environmental policy by confining its use only to where it is appropriate, recognizing its limitations and avoiding the temptation to take it over as an easy way out of facing the conflicts that beset us in other areas of policy (1998:111).

Sneddon et al. (2006) advocate for a pragmatic approach, acknowledging the failings of sustainable development discourse, but arguing for

> a resurrection of [sustainable development] into a more conceptually potent and politically effective set of ideas and practices … a middle and pragmatic path, one that takes seriously calls for radical changes in our ideas and institutions dealing with sustainable development, while also holding out the possibility that genuine reform of current institutions may be possible (2006:260).

The above arguments highlight the need for critical evaluation of the concept in use; of the need for transparency and rigour in engagement with sustainability principles; and of the need to demand meaningful and significant change from mechanisms claiming sustainability credentials. To combat ambiguity it is critical that any attempts to operationalise sustainability principles present a clear and transparent engagement with definitional and conceptual approaches (see Lélé 1991; Diesendorf 1997; Hodge 1997; Mawhinney 2002; Connelly 2007). In acknowledging the contested nature of sustainability and sustainable development, Diesendorf (1997:83) for example makes a point of deliberately making his value judgements explicit "rather than cloaked in neutral language". This acknowledgement of values reflects an acceptance of the fact

that there is a multitude of different understandings of sustainability and approaches to sustainable development, and that seeking a single definition or a definitive approach is therefore senseless. Rather, it is the clear and transparent identification and justification of how concepts of sustainability and sustainable development are employed that enable any particular approach to be validly debated, assessed and accepted (or rejected) in the public realm (Lélé 1991; Connelly 2007).

3.3 Operationalising Sustainability in Urban Development

Cities, as concentrations of population and built form, are also concentrated centres of resource consumption and waste production, which challenges the application of sustainability principles. However, this concentration also enables many efficiencies not possible in diffuse populations (Rees 1997). For example, it can reduce the economic and environmental costs of supplying essential services such as water, sewerage and waste collection; facilitate recycling of materials; and maximise the potential for effective use of low energy intensity transport such as walking, cycling, and public transport. Concentrating and containing built form also maximises the potential to conserve biologically productive and pristine environments. In addition to these opportunities to reduce the direct ecological impacts of cities, there are other social benefits that cities provide, being centres of innovation, creative potential and cultural development.

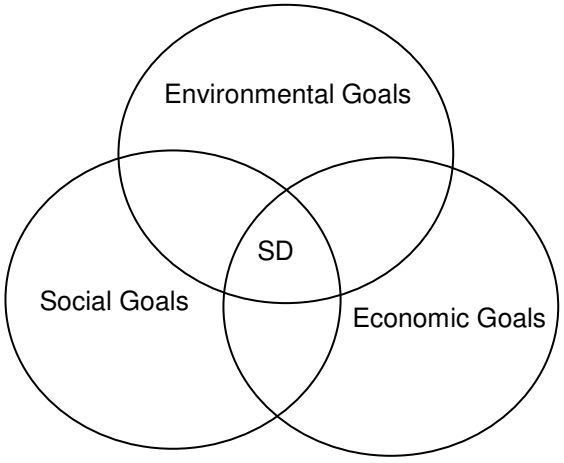
Despite this potential for increased efficiencies, cities are still almost wholly dependent on external sources of resources, and external assimilation of waste. For many, then, the concept of a sustainable city is an oxymoron (Blassingame 1998; Rees 1997; McManus 2005). The same logic can be used to highlight the flaws in the concept of the sustainable suburb which, in addition to being dependent on external environments for resources, is also dependent on the services of the surrounding city itself. Achieving a self-sustaining city or suburb, as defined by the physical boundary of the urban form, is virtually impossible. But this critique of the concept of a 'sustainable city' does not conclude that the principles of sustainability should be abandoned in cities, or that cities should be abandoned in the quest for sustainability – quite the opposite. As

Satterthwaite (1997) highlights, it is not cities *per se* that we should seek to sustain, but rather meeting human needs without depleting environmental capacity. Therefore one needs to consider how cities can best be managed and developed to *contribute* to sustainability, rather than seeking to achieve the self-sustaining city. There are two dominant conceptual articulations of sustainable development in the context of cities and suburbs evident in the literature: the domains approach; and the systems approach and its associated metabolism model of cities.

Domains-based approach

A widely used conceptualisation of sustainable development is that of the *three domains* of concern: environmental, economic and social (Connelly, 2007). The conceptualisation presents sustainable development as the simultaneous consideration of issues within these domains. The three circle diagram (Figure 6) is seen as an effective way to communicate the concept of sustainable development. It suggests both the holistic scope of the concept and the claim to integration. The clean boundary of the overlapping circles presents sustainable development as a "unitary, unambiguous concept or goal" (Connelly, 2007:263), and as such, this model inherently appeals to a *balanced* approach in the consideration of the three issue domains identified.

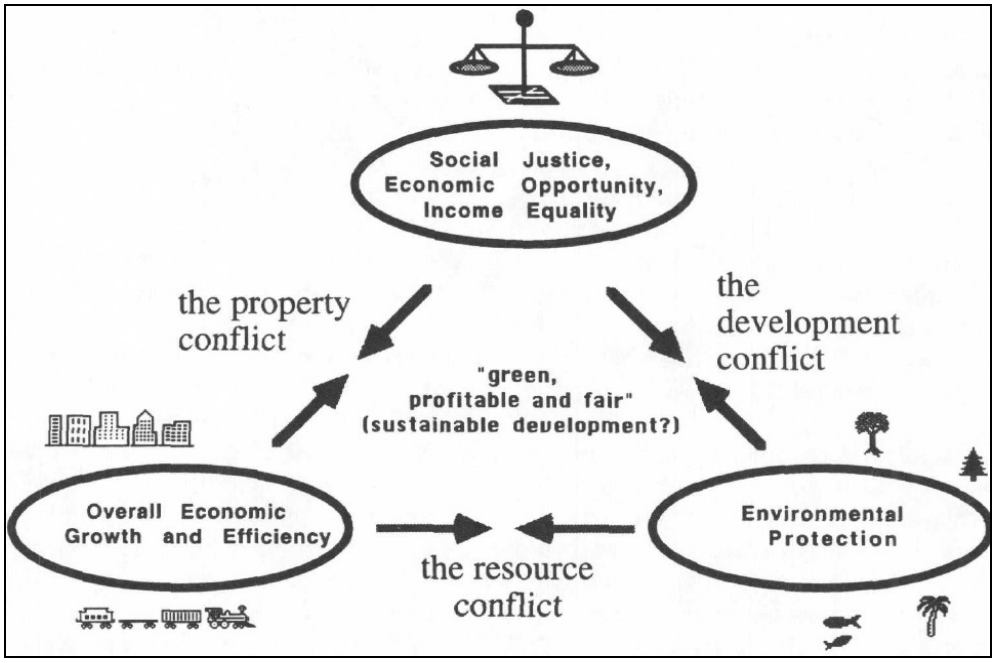
Figure 6 – The 'three-domains' approach to sustainable development.



A variation on the three-domains approach is Campbell's planner's triangle (1996) (Figure 7). This represents an attempt to operationalise the three domains approach in

the context of built environment decision-making, in particular, the role of the urban planner. In contrast to the aspirational goal of *balance*, represented in the three overlapping circles (Figure 6), Campbell's triangle effectively illuminates the conflict and tension inherent in the three-domains approach. The three points of Campbell's triangle can be seen as representing three goals of planning: social justice; economic efficiency; and environmental protection. The three goals are cast as primarily divergent, and the axes represent the three fundamental conflicts between these goals. The challenge for planners is to reconcile these conflicting goals to achieve sustainable development.

Figure 7 – Campbell's triangle of conflicting goals for planners.



(Campbell 1996)

The three-domains model, or derivatives of it, are widely popular in practice, with so-called *triple bottom line* (TBL) approaches to sustainable development particularly common. In operationalising sustainability principles in an urban development context, the domains approach sees urban issues grouped into areas (most commonly economic, environmental and social). This approach is often used to assist in identifying the variety of issues at play in an urban development context and to ensure that environmental and social issues are not left out of decision-making processes. Its goal,

then, is to provide a comprehensive and balanced consideration of key issues identified as relevant to sustainable development. This domains-based understanding and attempt at operationalising sustainable development in an urban development context is exemplified by Blair et al. (2003; 2004) who developed a set of performance indicators for the sustainability of existing suburbs in Australia based on TBL domains. In an urban policy context, *Melbourne 2030* activity centre policy also provides a typical example, with performance criteria established for the ongoing development of activity centres based on environmental, economic and social measures (State of Victoria, 2002).

Using TBL as a vehicle for operationalising sustainability is convenient, however it has limitations and is subject to considerable criticism (limitations and criticisms are addressed in detail in Chapter 4 in the context of TBL as a framework for sustainability assessment), based on the lack of connection with principles of sustainability; and a lack of engagement with the relationships that exist between elements of the economic, environmental and social domains. Sutton (2004:6), for example, points out that the widespread use of the three-domains has led many to define sustainability as the "integration of environmental, social and economic issues", a move which Sutton describes as "a classic mistake of confusing means with ends (i.e. methods with goals)" (2004:11). In Hodge's analysis of conceptual models of sustainable development, the three-domains model is highlighted as making "a significant contribution by clearly identifying the need to balance different sets of values and goals" (1997:29). However, he argues that the concept has limitations in application, highlighting that while

> words like 'social', 'environmental' and 'economy' may well be appropriate for designating general categories of knowledge … they do not describe a well-defined set of system components that systematically capture the human-ecosystem relationship (Hodge 1997:29).

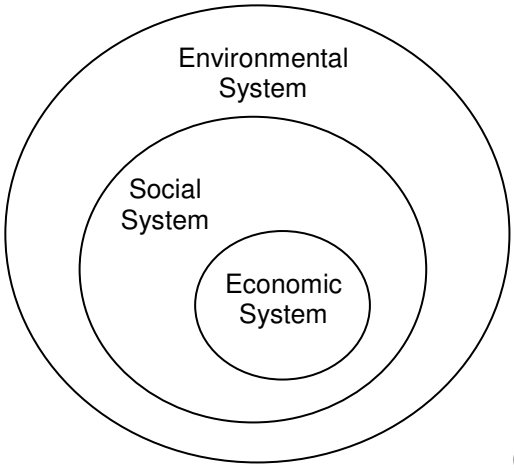
Systems-based approach

While the three-domains approach presents the three issue areas as an organising framework for considering sustainable development, a systems perspective attempts to go beyond a simple issues-based framework. It considers the system dynamics of the human-environment relationship, describing the components of a system and identifying interactions between those components. Systems thinking seeks to understand real

world phenomena through considering systems of elements, actions and interaction – including constraining relationships, feedback effects and system-wide properties – rather than just individual parts (Checkland 1981; Li 2007).

Hodge (1997) provides a systems-based conceptual model of the social, environmental and economic domains (Figure 8). Here a nested diagram is used to convey the dependence of social systems on environmental systems, highlighting the dependence of humanity upon the Earth, and of the economy as a human construct to manage some functions of society. Comparing the overlapping circles diagram (Figure 6) with the nested circles diagram (Figure 8) reveals a critical difference between domain-based and systems-based approaches to sustainable development: the former emphasises the importance of a *balanced* approach to economic, social and environmental issues, while the latter emphasises humankind's *dependence* on ecological systems, with economic systems a social construct.

Figure 8 – Systems approach to sustainable development.



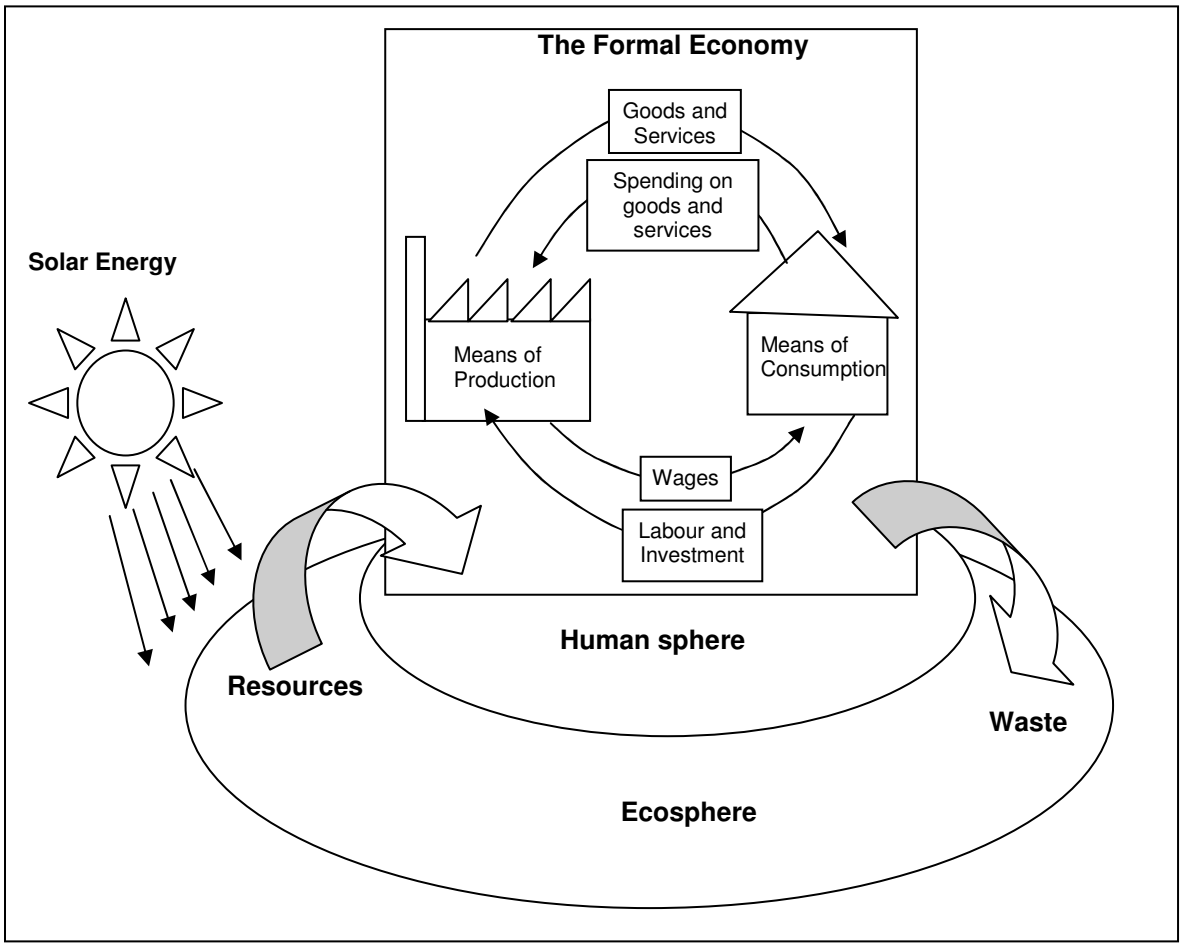
(Hodge 1997)

Wackernagel and Rees (1996) take this further, highlighting the way in which humans depend on nature to provide materials, absorb wastes, and provide the conditions (such as clean air and a stable climate) necessary for life (Figure 9). Often referred to as an ecological world view (Krebs 2008), it posits the traditional economic system, which "emphasises the seemingly self-generating circular flows of money between firms and households in the marketplace" (Wackernagel and Rees 1996:42), within its ecological context, where the "circular flows (of the market place) are actually sustained by the

unidirectional throughput of ecological goods and services from and to the ecosphere" (Wackernagel and Rees 1996:44). Low et al. (2005:37) put this world view in a universal context:

> Human systems of production, consumption, government and culture are subject to the ecological resources of the planet, a closed system containing wealth accumulated over 4 billion years, but with only one energy input – from the sun – and no outlet for waste.

Figure 9 – Expanded systems perspective on sustainable development.



(After Wackernagel and Rees 1996; Low et al. 2006)

This ecological systems perspective is based on the concept of carrying capacity and the understanding of ecosystems, their function and their limits. Founded in ecology and natural sciences, the concept was developed in the 1970s, and in broad terms is defined as "the ability of natural and man-made systems to support the demands of various uses" (Godschalk and Parker 1975:161). It is based on the recognition that society is

dependent on certain ecological functions, such as the provision of clean air and water, fertile soil, and the assimilation of wastes; and that human activity has an impact on the capacity of ecological systems to provide such functions (Rees 1996). Recognition of limits to such systems leads to an understanding of the limits to human growth and development – limits that, when exceeded, can cause serious and irreversible damage to ecological systems (Godschalk and Parker 1975; Oh et al. 2005).

Carrying capacity has long been identified as a potentially useful concept in planning and urban development, as it considers the capacity of ecological systems to sustain proposed growth and development, and highlights the relationship between development and ecological systems (Schneider et al. 1978:10). In theory, if one can assess available carrying capacity, and assess the demands of development, one can ensure sustainability by keeping demand within capacity.

The theory of ecological modernisation, though, questions the notion of fixed carrying capacity and ecological limits, arguing that the positive role that technology can play in the discovery, extraction, and processing of resources, and the processing and treatment of waste, can outweigh negative impacts on ecological systems, thus enabling continual improvement in our ability to meet our needs and effectively expanding carrying capacity over time (Spaargaren and Mol 1992). Langhelle (2000) cautions against this technological optimism, arguing that while ecological modernisation has much to offer in improving technical and industrial processes, it does not satisfy the principles or aims of sustainable development, in particular its concern for the viability of future generations to meet needs. Gunder (2006:218) is more critical, arguing ecological modernisation's interpretation of sustainable development fails to address the "maintenance of the biosphere" or the "needs of the disadvantaged" and thus represents protection of the interests of those satisfied with the "status quo of competitive globalisation". Others accept the carrying capacity theory but question its usefulness in practical application, highlighting the difficulties and complexities in calculation, with many variables, lots of data required, and contested calculation methods (Schneider et al. 1978). Nonetheless, there is an increasing acceptance that there are biophysical limits in capacity to support human growth and development (Alberti 1996; Langhelle

2000). Carrying capacity is a valuable concept to aid understanding of the ability of the Earth's resources to sustain human populations and how those resources are appropriated (Rees 1992; 1996).

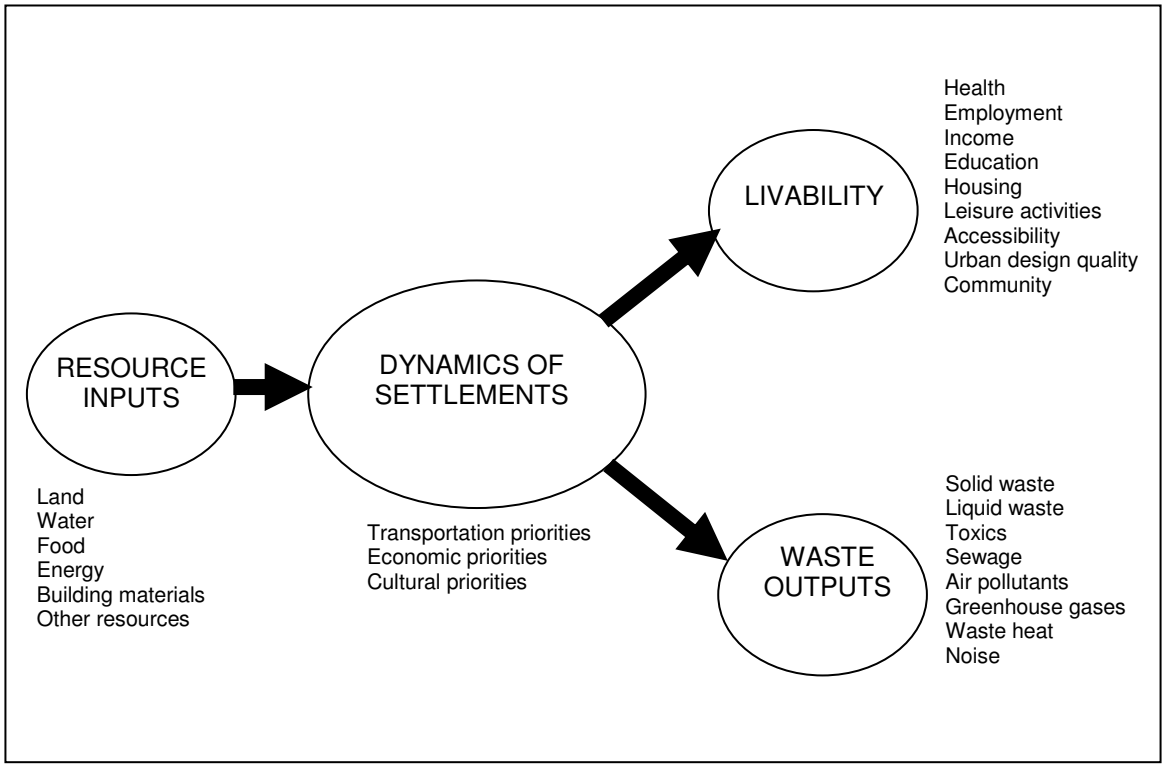
An ecological systems perspective can also be employed to examine the role of cities in the context of sustainability. In this approach cities are viewed as a complex system of elements and interactions. Considering the impacts of individual elements and proposing changes to those elements is thus viewed in the context of the system(s) that they exist within. From a systems perspective the functioning of a city does not exist in isolation, and so must be considered in the context of the areas that provide its resources and assimilate its waste – what Rees (1996) refers to as the city's hinterland. The hinterland of a contemporary city in this context is conceptual, not literal. In an increasingly globalised world, resources are sourced from across the globe, and wastes (such as GHG emissions) have global impacts. Rees (1997) argues that cities must be re-conceptualised, with the city boundaries expanded from the traditional boundary of the physical urban form to include all areas that are required to sustain the city. In what is often called the metabolism approach, the city is viewed as a system, comprising the central node of consumption and waste production, and the hinterland on which it depends. It is the sustainability of the global hinterland upon which the sustainability of the city is founded.

The metabolism approach, which built on the work of Wolman (1965) and Boyden et al. (1981), has become the dominant way of understanding the ecological aspects of the relationship between cities and the environment, through the work of Girardet (1999), Rees (1997), Wackernagel and Rees (1996), and others. The metabolism of cities refers to the "continuous flows of energy and materials to and from the environment" to produce and operate the buildings, infrastructure and machines of cities for the benefit of their inhabitants (Girardet 1999:32). The metabolism approach to cities stresses that while cities are major components of the human economy, they are also sub-systems of the materially closed ecosphere: "cities (indeed, the entire human enterprise), exist in a quasi-parasitic relationship to the rest of nature" (Rees 1997:307). The metabolism of cities is a predominantly linear flow of virgin resources being extracted, harvested,

manufactured and consumed by cities; and wastes being emitted and assimilated by the environment. Girardet (1999:32) argues that we should model cities on more circular ecological systems "in which every output which is discharged by an organism also becomes an input which renews and sustains the continuity of the whole living environment of which it is a part".

Using the metabolism approach to cities, one can analyse the flows of energy and materials to better understand the relationship between the city and the ecosphere that sustains it. This understanding of humanity's relationship with the environment as a system underpins a number of approaches to assessing the environmental impact of cities, including ecological footprint, which will be introduced in Chapter 4.

Figure 10 – Extended metabolism model of human settlements.



(Newman and Kenworthy 1999)

Newman and Kenworthy (1999:8) present an "extended metabolism model of human settlements" which builds on the metabolism approach to cities by incorporating further elements of the dynamics and liveability of cities, allowing the city's human basis to be

represented alongside the physical and biological basis (Figure 10). The metabolism approach tells us that to reduce the ecological impact of cities we must reduce resource inputs and waste outputs, and maximise circular flows rather than linear throughput. Through the extended metabolism approach, Newman and Kenworthy (1999) argue that sustainable development in cities must also be about increasing human liveability. As such, sustainable development as applied to cities can be defined as reducing resource inputs (land, energy, water and materials) and waste outputs (gaseous, liquid and solid waste) while simultaneously improving lives of citizens through elements such as health, employment, income, housing, leisure activities, accessibility, public space, and well-being.

The metabolism approach is used in an attempt to derive meaningful, measurable components from the abstract concept of sustainability. It reveals a range of actions required to facilitate, or operationalise, sustainability in a city. Using the extended metabolism model, Newman and Kenworthy (1999) present goals and indicators for a sustainable city under five headings:

- Energy and Air Quality – focused on reducing fossil fuel consumption and associated GHG emissions; and increasing proportion of renewable energy.
- Water, Materials and Waste – focused on reducing use of water and materials; reducing solid and liquid waste outputs; and increasing recycling of wastewater and solid wastes.
- Land, Green Spaces and Biodiversity – focused on protection of bioproductive or biologically diverse urban fringe land; and increasing density linked with transit orientation to reduce urban land take.
- Transportation – focused on reducing car use; and increasing proportion of walking, cycling and public transport.
- Liveability, Human Amenities and Health – focused on decreasing urban health risks; increasing access to amenities and services; and improving urban design to facilitate higher density mixed-use urban villages.

There have been many other commendable attempts to present similar frameworks for operationalising sustainability in the design of new neighbourhoods and in retrofitting

existing urban areas, based on meaningful and transparent engagement in sustainability principles and an operational understanding of urban environments (Low et al. 2005; McManus 2005; Newman and Jennings 2008; Jepson and Edwards 2010). Low et al (2005:70) for example, determine the following six principles for 'green' neighbourhoods:

- Minimise the use of resources, seeking to achieve household, neighbourhood and/or city self sufficiency.
- Be responsive to the natural environment, integrating landscape into neighbourhood plans, making open space attractive and useful, and protecting biodiversity.
- Minimise the need for travel, and maximise low energy modes of transport (pedestrian, bike and public transport), to enable people to connect with the local neighbourhood and the wider city.
- Design for permeability and inclusiveness, with active public space and no gated communities.
- Design public space for personal safety, keeping spaces open to view, overlooked and well occupied.
- Insist on affordability and inclusiveness, with housing available to everybody, whatever their budget or physical capabilities.

The diversity and contention in sustainability discourse necessarily makes transferring theoretical concepts into practice problematic (Jepson and Edwards 2010). The above contributions attempt to combine the principles of sustainability with a functional understanding based on the metabolism approach to generate an issues-based framework for operationalising sustainable development in urban contexts. While the details of the frameworks can be debated, they are founded on a transparent engagement with principles, and a transparent theoretical model for understanding urban – environment relationships; and thus attempt to capture the full significance of sustainability in an urban context.

3.4 Implications for Research

Sustainability and sustainable development now appear throughout policy documentation as the dominant organising concepts for consideration of the human-

environment relationship. There are, however, a great many differing approaches used in various contexts and for different ends. As such, there is concern that interpretations of the concepts of sustainability and sustainable development have broadened to the point where meaning and effectiveness in application is often questionable, leading to arguments to abandon them altogether as organising concepts for change. However, there are also advocates arguing for sustainability discourse as a means of articulating policy contexts, framing debate, and interrogating urban systems. Taking the latter as a starting point, the research documented in this thesis recognises the contribution that sustainability and sustainable development concepts can make towards understanding the human-environment relationship, and for challenging and changing existing damaging development trajectories. The pervasiveness of their use underscores the importance of engaging in sustainability debates and demanding integrity in attempts to operationalise sustainability. Without critical engagement the concepts risk being lost to other powerful agendas, appropriated for the purposes of reinforcing 'business as usual' approaches to the human-environment relationship under the guise of progressive change.

It follows that there is a need to investigate how sustainability and sustainable development are being used to inform practice, the effect this is having, and the directions needed to ensure meaningful and significant engagement with sustainability principles. Given the diverse and contested nature of sustainability debates, and the inherent subjectivity in interpretations, there is a critical need to demand integrity and transparency in engagement with sustainability. Only then can approaches be adequately evaluated and judged on their merits in the public realm. This includes defining what sustainability and sustainable development mean in a given context, through a transparent engagement with sustainability principles. The literature discussed in this chapter presents a strong case for two fundamental principles of sustainability: the principle of protecting, maintaining and enhancing ecological systems; and the principle of meeting human needs in an equitable way. It is argued that these principles are consistently evident in most transparent and rigorous discussions of sustainability (as summarised in Table 1).

Table 1 – Principles of sustainability.

	The principle of protecting, maintaining and enhancing ecological systems	***The principle of meeting human needs in an equitable way***
Brundtland Report (WCED 1987)	Operate within ecological limits to ensure ability of future generations to meet needs.	Development to meet human needs, particularly the world's poor.
Inter- and intra-generational equity (see UNSD 1992; George 1999)	Preserve ecological services for future generations to ensure inter-generational equity.	Provide equity in well-being/quality of life within generations to ensure intra-generational equity.
Dual imperatives (Wackernagel and Yount 2000)	The ecological imperative: operate within Earth's bioproductive regenerative capacity.	The socio-economic imperative: adequately provide quality of life for people all over the world.

There are two dominant approaches in applying sustainability principles to cities: the domains, or issues approach; and the systems approach. The domains-based approach expands the issue focus of development from economic parameters to include environmental and social issues, while the systems approach is used in attempts to understand the relationship between urban development and ecological systems. The domains approach is useful in expanding issue scope, however only the systems approach provides a method for understanding the ecological implications of different urban development trajectories. While both approaches can be used as a basis for efforts to implement sustainability principles in a particular urban development setting, the systems (or metabolism) approach provides for a more detailed engagement with the complex interactions between human activities and ecological systems.

This research draws on a principles-led approach to sustainability, combined with a systems-based understanding of cities, to identify functional objectives for operationalising sustainability in urban development. Using a principles-led approach ensures that the core principles of sustainability underpin any attempts to operationalise sustainability, and that actions are driven by these principles. Applying a systems

understanding to cities, through the extended metabolism approach, provides a rigorous and systematic way of understanding the interactions between human activities and the environment – that is, an understanding of the ecological implications of urban existence and urban development.

Table 2 presents functional objectives for operationalising sustainability in an urban land development context, drawing on the work of other similar sustainable urbanism frameworks (Newman and Kenworthy 1999, Low and Gleeson 2005, and Jepson and Edwards 2010). The objectives are organised into two sections (following the dual principles of sustainability outlined in Table 1 above): objectives relating to the ecological dimension of sustainability; and objectives relating to the socio-economic dimension of sustainability. Under the ecological dimension, objectives are grouped into four issue areas: energy consumption and GHG emissions; water cycle impacts; materials and solid waste; and biodiversity and ecology. Under the socio-economic dimension, objectives are grouped into two issue areas: increasing quality of life; and increasing equality.

While not presented as a definitive set of issues for urban sustainability, the objectives presented in Table 2 constitute a rigorous, relevant and justified set of issues with which to engage in a more detailed examination of the operationalisation of sustainability in an urban development context. The objectives are presented in qualitative terms and do not specify the extent of change required to warrant sustainable urbanism, as their intended purpose is to assist in identifying the critical issues of importance in achieving sustainability in the context of MPE development. It is used in this research to evaluate issue coverage in the case study assessment tools being examined, and thus constitutes an important element of the analytical framework developed in Chapter 5. Prior to discussing the development of the analytical framework, however, it is necessary to explore in more detail the principles and approaches to sustainability assessment that inform the conceptual and theoretical foundations of the tools being examined. These issues are addressed in Chapter 4.

Table 2 – Objectives of sustainability in urban environments.

Objectives relating to ecological dimension of sustainability:

- Energy consumption and GHG emissions:
  - Reduce energy (electricity and gas) consumption and/or replace with renewable energy (solar/wind/accredited green power); or eliminate/offset GHG emissions.
  - Increase mode share of public transport to reduce use of fossil fuel intensive transport.
  - Increase viability of walking and cycling to reduce use of fossil fuel intensive transport.
  - Reduce distance required to travel by providing or locating near services and employment.
- Water cycle impacts:
  - Reduce water consumption.
  - Improve stormwater management – improve water quality, reduce quantity.
  - Protect and rehabilitate natural waterways.
- Materials and solid waste:
  - Increase use of ecologically preferable materials.
  - Reduce solid waste impacts.
- Biodiversity and ecology:
  - Protect local bioproductive land, biodiversity and ecology.

Objectives relating to socio-economic dimension of sustainability:

- Increase quality of life:
  - Community development
  - Provision of safe urban environments
- Increase equality:
  - Provision of affordable housing
  - Community consultation.

Chapter 4: Sustainability Assessment

Introduction

The proposition developed and presented in the preceding chapters is that cities have extensive ecological impacts, and that sustainability principles must be applied to urban development to reduce these impacts. In arguing for this change to urban development practice, it follows that there is a need for means to assess the changing relationship between cities and the environment, and means of evaluating development proposals and guide the planning and implementation of preferred development options (Brandon and Lombardi 2005; Oliveira and Pinho 2010). Assessment acts as a means to foster better decision-making. In addition, the activity of developing assessment approaches plays an important role in embedding new concepts and principles in emerging fields of practice, helping to facilitate dialogue between diverse stakeholders (Todd et al. 2001:325). Increasingly the urban development sector is engaging with the rhetoric of sustainability, and producing and utilising sustainability assessment and certification tools to assist in operationalising sustainability and legitimising claims to sustainability.

The term 'sustainability assessment', as used in this thesis, refers to assessment processes that aim to reveal performance against sustainability principles, and direct decision-making towards sustainability (Gibson et al. 2005; Hacking and Guthrie 2008; Bond and Morrison-Saunders 2011). The challenge, as Gibson et al. (2005) point out, lies in identifying the requirements of sustainability, and how decision-making processes regarding trade-off choices are managed. This chapter first considers the overarching debate on the principles of sustainability assessment, considering how sustainability principles should translate into assessment. This debate is less concerned with the detail of how assessment is carried out, focusing instead on principles that should underpin sustainability assessment. Evident in literature and practice are a number of approaches to sustainability assessment and, despite significant overlap, there are contradictory elements between approaches (Brandon and Lombardi 2005; Hacking and Guthrie 2008). This chapter considers several key methodologies used in sustainability assessment: extensions of established methods such as Environmental Impact Assessment, and Strategic Environmental Assessment; domain-based

frameworks such as the ubiquitous 'triple bottom line'; principle to indicator approaches; and urban metabolism approaches. These are not necessarily mutually exclusive approaches, and often exist in combination; however, they do present useful categories with which to consider the dominant conceptual ideas used to inform sustainability assessment methodology. Some of this literature operates at a theoretical level, but most is situated in particular applied contexts, such as international development, product production and consumption, or urban development. Within the urban development sphere there has been significant attention paid to sustainability assessment at the building scale (see Todd et al. 2001; Arup Sustainability 2004; Retzlaff 2008; Retzlaff 2009) and at the city-wide indicator scale (see Sustainable Seattle 1998; United Nations 2001; AUIS and City of Melbourne 2005) but limited engagement at the neighbourhood or MPE scale. The chapter concludes by summarising debate on the principles and approaches to sustainability assessment, establishing the elements of most relevance in the context of sustainability assessment of MPEs.

4.1 Principles of Sustainability Assessment

As discussed in Chapter 3, the concept of sustainability is subject to considerable debate, conjecture, and lack of consensus; and this is mirrored in debates surrounding sustainability assessment. Sustainability discourse includes an active discussion on how to best assess sustainability. As with broader sustainability discourse, this accelerated following the release of the Brundtland Report in 1987 and UNCED in 1992 which specifically identified the need for assessment capability in the context of sustainable development (UNSD 1992). However, the field of sustainability assessment theory and practice is relatively young, and while there is general agreement that sustainability assessment is needed to aid decision-making, there is debate in the literature surrounding theoretical approaches and practical implementation (Bond and Morrison-Saunders 2011).

Many conclude that the disagreement surrounding sustainability is inescapable, and that therefore sustainability assessment is necessarily an exercise informed by values and political decision-making processes (Maclaren 1996; Diesendorf 1997; Hodge 1997; Mawhinney 2002; Newman 2004; Gibson et al. 2005). Decisions are constantly being

made about what to measure, how to measure, where to place emphasis, and where trade-offs and compromises are permitted. Some of these decisions are obvious in assessment approaches, but many are hidden in assumptions and methods. Hodge (1997:82) argues that assessment must necessarily engage with a process of exercising judgement and values, and that the only way to maintain integrity in sustainability assessment is to "demand an explicit expression of operating values". The use of imprecise or ambiguous language and terminology is a major problem with evaluation, and the use of clearly defined concepts and principles is deemed critical to the effective application of sustainability assessment (Roberts 2006).

There have been several attempts to develop general principles to guide sustainability assessment which are relevant to the specific scale of focus in this research (see Hardi and Zdan 1997; Brandon and Lombardi 2005; Roberts 2006; Retzlaff 2009). Common amongst them is a focus on accountability, delivered by clarity and transparency of assessment approach. While developed in the context of international sustainable development projects, the *Bellagio Principles for Assessment* provide a comprehensive treatment of sustainability assessment principles (Hardi and Zdan 1997). The development of the principles responded to the recognised need for some consistency and rigour in sustainability assessment process. Rather than seeking agreement on particular methods of assessment or particular measures or indicators of sustainability, an exercise that Roberts (2006:522) likens to the "medieval quest for the philosophers stone", the Bellagio principles were developed as "pragmatic guidelines" to provide "a link between theory and practice" (Hardi and Zdan 1997:8). The ten Bellagio principles are summarised in Table 3 (for detailed specification see Hardi and Zdan 1997). In the following discussion, the Bellagio principles are used as a reference point to discuss general principles for sustainability assessment, and are considered along with other contributions to the debate. The discussion elaborates on the key requirements of sustainability assessment, structured around four themes evident in the literature: vision, purpose and objectives; scale and scope; assessment method; and achieving change.

Table 3 – Bellagio principles for assessment.

1. Guiding Vision and Goals: assessment should be guided by a clear vision of sustainable development and goals that define that vision.
2. Holistic Perspective: assessment should consider social, ecological and economic dimensions; and consider positive and negative consequences for human and ecological systems.
3. Essential Elements: assessment should consider equity within and between generations; the ecological conditions on which life depends; and development that contributes to social well-being.
4. Adequate Scope: assessment should consider appropriate time spans and spatial spans to ensure needs of future generations are met, and long distance or global impacts on people and ecosystems of local projects are captured.
5. Practical Focus: assessment should clearly link vision and goals to an explicit organising framework of measures, indicators or criteria; limit issue focus and measures while providing clear signals of progress; and standardise measurement where possible to allow comparison.
6. Openness: assessment should make methods and data accessible to all; and make explicit all judgements, assumptions, and uncertainties in data and interpretations.
7. Effective Communication: assessment should address the needs of its audience and users, aiming to adequately stimulate and inform decision-making.
8. Broad Participation: assessment should ensure it reflects a broad representation of the values of stakeholders.
9. Ongoing Assessment: assessment should be able to be repeated to determine trends; and be iterative and adaptive as new insights are gained.
10. Institutional Capacity: assessment should be assured by capacity in institutions to provide ongoing rigorous assessment.

(after Hardi and Zdan 1997)

Principles and objectives

While there is considerable debate and conjecture surrounding many elements of sustainability assessment, the first Bellagio principle – which states the need for guiding vision and goals – recurs consistently throughout the literature. A clear and transparent explanation of approach, with explicit reference to sustainability principles, and a meaningful translation of those principles into goals or objectives, is consistently identified as a fundamental requirement for sustainability assessment (Hardi and Zdan 1997; Hodge 1997; Todd et al. 2001; Newman 2004; Gibson et al. 2005). A clear

articulation of objectives reduces ambiguity of intent by identifying what the process of assessment aims to achieve (Hardi and Zdan 1997; Roberts 2006). Defining the objectives and purpose of an assessment approach is also critical to establishing internal consistency, which requires that there is an explicit link between the measures of an assessment approach and the overall vision and objectives (Roberts 2006). This is closely aligned with the concept of merit in evaluation studies methodology, introduced in Chapter 1, which requires that an object of evaluation has clearly defined objectives, and the means to deliver on those objectives (Stufflebeam and Shinkfield 2007).

As assessment involves judgements against an expression of what is right, or valued, a clear understanding of the principles that motivate assessment is essential (Roberts 2006). Both Newman (2004) and Gibson et al. (2005) make the assertion that the driving force behind sustainability assessment must be a transparent and meaningful engagement with widely supported sustainability principles. This is supported by the Bellagio principles, which reiterate the fundamental sustainability principles of inter-generational and intra-generational equity, and dependence on ecological systems (second, third and fourth Bellagio principles). This engagement with a principles base aligns with the concept of worth in evaluation studies methodology, introduced in Chapter 1, which argues that beyond delivering on its own stated objectives, a subject of evaluation should be examined against broader relevant principles and objectives (Stufflebeam and Shinkfield 2007).

Assessment method

Bellagio principle six addresses the importance of transparency and justification of sustainability assessment methods. Given the variety of methods used in sustainability assessment, which are discussed in detail later in this chapter (Section 4.2), it is critical that the method used is transparent, systematic, and repeatable (Hardi and Zdan 1997; Roberts 2006). Assessment should possess openness, with methods and data accessible to all, and judgements, assumptions, uncertainties and interpretations made explicit (Hardi and Zdan 1997). Central to any assessment method is the method of measurement and scoring used, including any processes of weighting and aggregating elements. A key distinction in measurement is whether specific issue-based units are

used, such as electricity consumption or vehicle miles travelled, or whether dimensionless units, or a points-based system, is established to allow comparison between indicators and facilitate aggregation.

Weighting and aggregating involves establishing the significance of each element of assessment, and combining elements to produce a clearer picture of assessment (Paracchini et al. 2008; Retzlaff 2009). These processes allow priority or varying levels of significance to be ascribed to different criteria, and evaluation data to be condensed in order to better inform decision-making processes (Paracchini et al. 2008). However, weighting and aggregation necessarily involves decisions regarding the value and importance of particular issues both inherently and in relation to each other, as represented by individual indicators or criteria, and is thus a normative process. It is frequently subject to criticisms of being opaque in process and purpose (George 1999; Todd et al. 2001; Mawhinney 2002) and of being a "function of the interests of the people involved with [the tools] development" (Retzlaff 2009:10). Weighting occurs directly, when measures are scored and aggregated to reflect their significance, and also indirectly as a result of the process of indicator or criterion selection (Retzlaff 2009). There is potential in this process to bias one area over another by employing a number of measures that are essentially a measure of the same criterion (for example, by counting both GHG emissions and energy consumption), or by omitting indicators of important issues in another – practices that, according to Segnestam (2002), are not uncommon.

Interpreting policy relevance and meaning from a suite of sustainability indicators or performance criteria can be a complex exercise and there is pressure to develop single aggregated measures of sustainable development to aid policy development and decision-making, and to provide a counter to the political and institutional dominance of economic only indices such as the Gross Domestic Product (Segnestam 2002; Moles et al. 2008). A key benefit of aggregated indices such as the ecological footprint and Genuine Progress Index is their ability to simply and clearly communicate sustainability performance to decision-makers and the general public.

However, attempts to reduce the complexity of issues embodied in sustainable development are open to considerable criticism. Aggregation can hide the significance of change in individual components of the indices. This, it is argued, makes indices less effective than disaggregated indicators in informing policy development and evaluation, where detail of the change in each of the relevant components of assessment can be important to complex decision-making processes (George 1999; Segnestam 2002; Hueting and Reijnders 2004). Essentially, aggregation is a form of evaluating indicators and performance criteria, as it involves a process of determining the significance of different measures and the trade-offs that are acceptable. Aggregation places the responsibility of this evaluation on the developer of the indices, presenting an aggregated result to the end user of the information. It is therefore important that the method of aggregation is transparent, such that the appropriateness of the value bases, and aggregation processes, can be judged for use in a given context. A disaggregated approach, while still requiring critical decisions (such as the selection of indicators to be used), leaves the evaluation of significance and the consideration of trade-offs with the decision-makers engaging with the indicator suite. This can allow a more transparent presentation of the issues being considered, leaving some weighting judgements to be made by decision-makers in considering the assessment results.

Achieving change

If sustainability assessment is to be effective, it must be able to influence decision-making towards more sustainable outcomes and bring about changes in development practice. To do this, assessment tools must be both practical in application and capable of effecting change. The remaining Bellagio principles address the issue of the practicality of assessment approaches and the level of resourcing required for their implementation. For assessment mechanisms to be effective they must add value in decision-making processes, having a clear scale and scope of application, and match the resource and institutional capacity of the contexts within which they are used (Hardi and Zdan 1997). This requires that the time and data and skill requirements are not onerous, and ultimately, that the costs involved are limited and justified. To add value to decision-making processes the outputs of assessment must also be relevant and understandable to the target audience (Hardi and Zdan 1997).

Urban assessment can target individual buildings; building sites; precincts or subdivisions; neighbourhoods; cities; regions; or even have global implications; and frequently assessment covers multiple scales (Retzlaff 2008). Assessment can also be carried out at different points in the urban development process. Assessment of urban development projects such as MPEs are typically carried out in three different phases of development, for three different but related reasons, characterised by Oliveira and Pinho (2010) as ex-ante, ongoing and ex-post (see also Roberts 2006). Firstly, assessment can be carried out in the planning and design phase of development (ex-ante), with the focus on evaluating intent and comparing possible alternatives, in order to inform design decision-making. Secondly, assessment can be targeted at the delivery phase of development (ongoing). This focuses on evaluating implementation at key stages against established objectives, and can result in alterations to the development. Finally, assessment can be targeted at completed developments (ex-post), focusing on evaluating outcomes against project objectives; and in the case of a principles framework such as sustainability, also evaluating outcomes against an established conception of the goals of sustainable development.

For sustainability assessment to bring about change, the objectives underpinning assessment must ultimately be reflected in the built form outcomes being assessed. This is particularly important of ex-ante assessment: if an assessment of design intent returns results indicating that the design will contribute to more sustainable outcomes, then such outcomes should also be apparent in the resulting built form, confirming the validity of the ex-ante assessment (Roberts 2006). It is therefore desirable that assessment approaches have in-built mechanisms to continually calibrate ex-ante assessment with final built form outcomes. Further, reflecting the changing nature of both political and scientific engagement with sustainability, assessment should have an in-built process for the ongoing re-evaluation of vision, goals and objectives, to ensure these remain relevant and are actively pursued (Bond and Morrison-Saunders 2011; Rametsteiner et al. 2011).

For assessment approaches to have legitimacy they must be able to effect change, and therefore be open and accountable so that the significance of assessment outcomes relative to sustainability principles can be verified. This requires that assessment methods are "inclusive [and] open … rather than exclusive and obscure" with assessment methods available for audit and scrutiny (Roberts 2006:530). The ISO/IEC standards on conformity assessment make the distinction between first-party, second-party or third-party assessment (Standards Australia 2005). First-party refers to assessment undertaken by the organisation that provides the object of assessment; second-party refers to assessment undertaken by an organisation that has interest in the object of assessment; while third-party refers to assessment undertaken by an organisation that is independent of the organisation that provides the object of assessment (Standards Australia 2005:1). While first- and second-party assessment have their place, the independence of third-party assessment provides for a greater degree of accountability. The conformity assessment standards establishes third-party assessment as the only means by which certification of achievement can legitimise result (Standards Australia 2005).

4.2 Implementing Sustainability Assessment

EIA and SEA as foundations for sustainability assessment

Following Brundtland and Rio, existing forms of environmental assessment were identified as potential departure points for sustainability assessment (UNSD 1992; George 1999). Since then, Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA) have been widely used as a basis for sustainability assessment, with their environmental focus broadened in scope to include consideration of social and economic factors, in line with a 'three-domains' approach to sustainability (George 1999; Eggenberger and Partidario 2000). EIA began in the 1960s and is now used extensively around the world, often officially incorporated into legislation as part of development approval processes (Thomas and Elliott 2005). SEA grew out of EIA, in response to the recognised limitations that the project focus of EIA presented at the strategic level, where a broad range of policy, plans, and programs must be considered.

EIA is generally applied to project proposals to identify environmental impacts and ways to avoid or minimise environmental damage (Thomas and Elliott 2005). It concentrates on the mitigation of localised environmental impacts and on the participation of local communities. While EIA focuses on assessing the environmental impacts of a given project or activity, SEA is targeted at assessing policies, plans and programs (Marsden 2002). SEA and EIA are often applied in a tiered approach, with SEA conducted proactively during the formation of policies, plans and programs; and EIA used in the subsequent implementation of projects (Shepherd and Ortolano 1996; Marsden 2002).

As established and institutionalised forms of assessment, EIA and SEA have been regarded by many as ready-made tools for applying sustainability assessment criteria (George 1999). However, they are subject to several key criticisms that place them at odds with the principles of sustainability. EIA is criticised as occurring too late in the decision-making process, after the majority of development decisions have been made. It therefore presents a reactive engagement with the decision-making process, rather than the proactive engagement that would be expected in an assessment of sustainability (Shepherd and Ortolano 1996). In the context of sustainability assessment, both EIA and SEA are criticised for not linking project impacts to wider regional or global concerns (Shepherd and Ortolano 1996; Dovers 2002). Perhaps most at odds with sustainability principles is the traditional focus of both EIA and SEA on mitigating impact (Shipworth 2002). Impact mitigation misses the scope and depth of issues embodied in sustainable development, and the difficult questions raised in sustainability discourse relating to the nature and trajectory of current development practice (Shipworth 2002). These limitations suggest that traditional EIA and SEA cannot fully meet the needs of sustainability assessment. However, as Hacking and Guthrie (2008) highlight, their established nature and strong environmental focus mean that they will continue to play an important role in taking planning and decision-making towards sustainable development.

Indicators and performance criteria approaches

Indicators are tools for analysing and understanding the status, and changing status, of complex social systems and the natural environment. As Bond and Morrison-Saunders (2011:2) describe: "sustainability assessment is commonly associated with the derivation of indicators which can be used as measures of the state of the socio-economic and biophysical environment". By focusing on key elements that are indicative of a system and its characteristics or functions, indicators are used to simplify complex systems or phenomena. In evaluating indicator data, attempts are made to understand the condition and trends of complex systems. This information, or feedback, on the condition and trends of systems can be used to inform decision-making, modify behaviours, and inform the development of policy, action plans and projects (Alberti 1996; Segnestam 2002). Indicators are often aggregated into indices, to further simplify the understanding of the status and change of key areas of concern (Segnestam 2002). Urban sustainability indicators aim to provide simplified understanding of urban systems, and their relationship with environmental systems (Alberti 1996).

Related to indicator-based assessment is the use of performance criteria. Performance criteria-based assessment is typically used in the planning and design stages of development. Performance criteria approaches generally consist of 'checklists' of criteria with an associated points scoring system, and are particularly prevalent in the sustainability assessment of buildings and increasingly evident in precinct scale assessment (Retzlaff 2008; 2009). As with indicators, performance criteria are often aggregated into overall scores to provide a simplified understanding of how sustainability objectives are reflected in a proposed development (Retzlaff 2008). In indicator assessment, the same indicators are examined across cases, and over time, with the variation in performance against indicators providing differentiation in assessment. In criteria assessment, on the other hand, a broader list of *ideal* attributes are generally established, with the object of assessment evaluated through a process of determining how many of the criteria are satisfied, often with a points system allowing 'partial' achievement of criteria. The key difference, therefore, is that indicator approaches establish a set of key elements that are used to indicate the level of performance of the object of investigation against objectives, while performance criteria

establish a list of elements that are sought in development, as contributing to objectives. The functional elements of these two approaches – indicators and criteria – have considerable overlap in practice; and in the context of this discussion on the desirable characteristics of these elements, indicators and criteria can usefully be considered together.

Current practice in the sustainability assessment of urban development draws heavily on indicator and performance criteria methodology, with many practitioners seeing this as the only feasible way forward for implementation and evaluation of sustainable development (Mawhinney 2002). There is extensive literature available on indicator theory and development, and on indicators for sustainable development, in which key requirements of indicators or performance criteria for sustainable development are established (see Alberti 1996; Maclaren 1996; Mawhinney 2002; and Segnestam 2002). Firstly, for indicators or performance criteria to be effective they must be able to meet objectives of assessment. That is, they must be responsive to changes in the key characteristics being observed, and ultimately able to provide diagnosis against the objective of assessment to which the indicator relates. Secondly, for indicators and performance criteria to be deemed robust and valid they must be clearly defined and unambiguous, have a transparent methodology for assessment, and be scientifically valid (or deemed valid by relevant experts and stakeholders). And thirdly, for indicators and performance criteria to be effective they must be practical, cost effective, and time effective with the required information available; and with outputs that are understandable, relevant and useful to identified end users.

Indicators and performance criteria are widely used in sustainability assessment as they are seen to enable the balanced assessment of economic, social and environmental issues. The challenge, however, is how to appropriately represent these issues. Segnestam (2002 highlights that bias towards particular issues is a common problem in indicator sets, with bias generally reflecting the experience and expertise of those constructing the indicator set or index. In theory, neutrality can be achieved through scientific justification or stakeholder consensus. Maclaren (1996:188) calls for multi-stakeholder input to sustainability indicators to overcome the "value laden and context-

sensitive" nature of sustainability. This is widely applied in practice, often leading to group decision-making or consultation being used as a proxy for neutrality, a process that necessarily requires an element of political decision-making (Mawhinney 2002).

Hueting and Reijnders (2004:255) caution against reliance on subjective approaches, arguing that when determining the "requirements for restoring and maintaining the environmental functions on which the living conditions of the current and future generations depend", many relevant parameters are quantifiable and scientifically justifiable; and therefore that consensus (and thus compromise) should not be allowed to trump justifiable physical limits. They argue for proper use of discipline expertise when developing and applying indicators, in particular dismissing the use of economic theory to assess ecological capacity. However, given that sustainability discourse itself is in part scientifically justified, and in part a normative, value driven concept, a combination of scientific rigour and political decision-making is a necessary component of indicator selection in the context of sustainability assessment (Mawhinney 2002; Rametsteiner et al. 2011). Rametsteiner et al. (2011) argue that all indicator selection, including seemingly technical indicators, is in part a political process of establishing (or reflecting) social norms, as the decision-making processes underpinning the selection of indicators necessarily requires those involved to make normative decisions on what to 'sustain' across a range of often competing factors. The challenge for indicator development, therefore, is to utilise scientific justification where appropriate to increase rigour, but to also acknowledge the "norm creation" element of indicator selection and to develop processes for selecting indicators that reflect this (Rametsteiner et al. 2011:64).

Assessment frameworks

Frameworks are often developed and used to organise indicators or performance criteria, ensuring that the characteristics of an issue being evaluated are covered by the selected measures, and helping to describe interrelations between the measures selected (Segnestam 2002). There are several prominent frameworks used in sustainability assessment: domain- or issues-based frameworks; principle or goal-based frameworks; and causal frameworks (after Maclaren 1996). Both domain-based and principles-based

frameworks are prevalent in sustainability assessment of urban development, while causal frameworks such as Pressure-State-Response frameworks (and its variations) are less evident, being more commonly associated with international development work, in particular the work of the Organisation for Economic Co-operation and Development (OECD) (Segnestam 2002).

Domain or issues-based frameworks start with a practical focus on key issues, grouping indicators accordingly. Such approaches can be based on organisational structures, using existing categories of responsibility to group indicators, making it easy to match accountability with measures (Maclaren 1996). Another approach used is to organise indicators based on issues that have resonance in the community, such as community safety or air quality, in order to foster popular appeal (Maclaren 1996). However the most common starting point for domains-based assessment is the three domains, or triple bottom line (TBL) conceptualisation of sustainability (introduced in Chapter 3). While the economic/social/environmental domains are most commonly used, other approaches make subtle changes, adding extra pillars, or splitting pillars into particular subgroups, to tailor assessment in a given context.

The TBL framework was initially an appeal to the business community to voluntarily include environmental and social concerns into its accounting and reporting processes, building on the concept of corporate social responsibility (Elkington 1998). TBL-based assessment approaches often build on EIA and SEA, placing emphasis on integrating the consideration of environmental with social and economic issues; and on promoting positive outcomes, rather than impact mitigation (Eggenberger and Partidario 2000; Pope 2003; Newman 2004; Hacking and Guthrie 2008).

The extensive use of TBL has attracted significant attention and there are several criticisms highlighted in the literature. It is suggested that TBL-based frameworks are overly simplistic interpretations of sustainability, wedded to existing divisions in theory and practice. George (1999:177), for example, is critical of broad indicator sets that attempt to comprehensively cover "every aspect of pollution control, waste management, nature conservation, resource depletion, social welfare, health, education,

employment opportunities, standards of living, etc" seeing this as an arrangement of traditional development goals, in traditional discipline frameworks, with the key principles of sustainability "submerged under a sea of age-old problems that are made no more readily soluble by bearing the label of sustainable development". Gibson et al. (2005) argue that the TBL concept is more useful for categorising and separating than for integrating, and often encourages entrenched division between existing disciplines and policy areas, particularly between the economic and the ecological. Critics of TBL also highlight the danger of this conceptual simplification becoming a proxy for sustainability in common understanding. As Sutton (2004:19) emphasises:

> The simple act of adopting a triple bottom line approach does not mean that an organisation is actively tackling sustainability issues, nor does it make clear what is being sustained, even if there is an intended connection to sustainability.

He goes on to argue that "the 'triple bottom line' concept … is simply a scope-widening mechanism to ensure that all major issues are considered" (2004:20).

Although it grew out of business reporting processes (Elkington 1998), TBL is increasingly being used as a sustainability assessment framework for governments and communities, particularly in Australia (for example, see State of Victoria 2002; ACIL Tasman and Tract 2005). Low and Gleeson (2005) opine that the primary role of government is to govern in the public interest and not to maximise economic returns. They argue that the inclusion of economic and social themes into ecological sustainability has diverted the focus away from sustainability's central project: continuous reduction in the economy's impact on the natural environment. It has, they suggest, only encouraged the sustaining of the status quo – a neoliberal program of continued growth.

These criticisms lead to assertions that TBL assessment approaches are acting merely as measures of elements that may lead to sustainability, rather than of sustainability itself. As Pope (2003:12) suggests, TBL type integrative assessment approaches generally "avoid attempting to define criteria or conditions for sustainability, and limit themselves to minimising negative triple bottom line outcomes or maximising positive ones". This type of assessment may indicate improved performance upon an established baseline,

but does not indicate whether a subject of assessment could be considered sustainable, or what would need to be changed to deliver a sustainable outcome. Pope (2003:34) maintains that "sustainability assessment should assess whether or not an initiative is sustainable, and not simply assess 'direction to target'", and that this requires "a clear concept of sustainability as a societal goal, defined by criteria against which the assessment is conducted".

In using existing discipline and organisational structures to drive the selection and organisation of indicators, domain-based approaches have a practical appeal. However, it is argued that such divisions do not equate to consideration of sustainability (Sutton 2004). They are thus criticised for being focused on mitigating impacts rather than seeking positive outcomes; for their propensity to emphasise potentially competing interests (rather than the linkages and interdependencies) thereby promoting 'trade-offs'; for justifying the prioritisation of economic requirements over other concerns; and for employing conventional disciplinary categories rather than encouraging new interdisciplinary thinking (Gibson 2000; Buselich 2002; Pope 2003; Sutton 2004). A broader problem with indicator framework approaches is their tendency, once established, to become proxy definitions of sustainability (Mawhinney 2002; Sutton 2004).

In response to these criticisms, many advocate the use of sustainability principles to drive framework development (George 1999; Gibson 2000; Mawhinney 2002; Pope 2003; Gibson et al. 2005). Mawhinney (2002) highlights that in many indicator sets, the method of transition from sustainability principles to an established set of indicators is neither clearly evident nor consistent. The principle to indicator approach recognises "the likelihood that a series of TBL goals will fail to fully describe the holistic concept of sustainability" (Pope 2003:18). It therefore attempts to re-engage with the key principles of sustainability, using indicator frameworks that begin not with a grouping of issues, but with core sustainability principles, and from there derive criteria or conditions for assessment (George 1999; Pope 2003). It is argued that by starting with what sustainability *is*, rather than issue domain categories, assessment can be better developed to determine whether sustainability principles are being achieved. George

(1999) draws attention to what he argues are the fundamental principles of sustainability: intra- and inter-generational equity. He contends that by applying these principles to the development of assessment criteria in EIA and SEA processes, they can be used for sustainability assessment. He develops a list of sustainability criteria, based on the sustainability principles of intra- and inter-generational equity, to broaden the scope of EIA to sustainability assessment. Gibson (2000) presents a similar approach, developing seven principles of sustainability, to inform the development of sustainability assessment processes and criteria (developed further in Gibson et al. 2005).

Behind both the TBL and principle-led approaches is a recognition of a need to shift from traditional environmental impact assessment, to a new set of priorities. The TBL approach is a widening of scope, from one dimension – environmental – to an integrated and balanced consideration of three dimensions – environment, economic, social. The 'principle to indicator' approach is fundamentally a change in underlying principles – a shift from that of harm minimisation that underpins impact assessment, to that of sustainable development.

Urban metabolism and carrying capacity approaches

Most sustainability assessment currently undertaken on urban developments is based on frameworks of criteria and indicators. There is, however, another type of sustainability assessment, derived from the urban metabolism approach to cities (as discussed in Chapter 3). These assessment approaches see the relationship between urban form and environment as an integrated system, and base sustainability assessment on the measurement of flows in this system and the capacity of the system to sustain those flows. They therefore seek to provide quantitative assessment of humanity's interaction with ecological systems, rather than relying on proxy indicators or criteria lists, thereby bringing increased detail and rigour to sustainability assessment. However, the difficulty of accurately measuring the impact of human activity has limited the use and influence of such approaches.

The most widely used of these assessment approaches is the ecological footprint. The concept and procedure for ecological footprint analysis (EFA) was developed by Rees and Wackernagel in the early 1990s, and popularised with their 1996 publication, *Our Ecological Footprint: Reducing Human Impact on the Earth*. The broad aim of this approach is to quantify the capacity of the Earth to provide for human existence, and the level to which human populations are appropriating this capacity. The ecological footprint of a given population or economy represents the 'ecosystem area' that is essential to sustain it (Wackernagel and Rees 1996:11).

EFA is an accounting tool – one that assists in the comparison of ecological supply and demand. On the supply side, the footprint methodology measures nature's *bioproductive capacity*. On the demand side, it measures a given population or economy's appropriation of this capacity through its consumption of goods and services and its production of waste – its *ecological footprint*. Both bio-productivity and ecological footprint are expressed in a common unit – the *global hectare* (gha). By calculating supply and demand in this manner, EFA aims to provide a vivid representation of the degree by which human consumption exceeds the regenerative capacity of the biosphere (Wackernagel and Rees 1996; Wackernagel and Yount 2000; Wackernagel et al. 2005).

There is an active debate around the merits of EFA, including consideration of specific components of the methodology and application. A persistent criticism relates to the use of bio-productive land as a metric for ecological supply and demand. The significant variability in the bio-productivity of land (over space and time) – and the fact that the impact of most human activities does not directly correlate to an area of land to sustain them – leads to concern that the "hypothetical land area … will be interpreted as actual or at least realistic land use" in policy development and decision-making (van den Bergh and Verbruggen 1999:64). Further, the methods of aggregating demands on nature and of converting these to a common unit are subject to debate. While converting the consumption of basic food crops, fibre crops and timber to productive land area is relatively simple, converting the consumption of refined metals, electricity, and fuel, or the emission of toxic waste, proves to be significantly more challenging.

Consequently, EFA methodology has been criticised for making untenable, or at least debatable, assumptions in calculating such conversions (van den Bergh and Verbruggen 1999; Ayres 2000; van Kooten and Bulte, 2000; Lenzen and Murray 2003; McManus and Haughton 2006).

Arguably the greatest strength of the ecological footprint is that it presents a simple, easily understood, aggregated measure of ecological impact. However, questions are also raised about the effectiveness and reliability of using a highly aggregated metric in guiding decision-making, with Ayres (2000:347) arguing that "while the EFA concept has some value as an indicator of current global unsustainability, it is too aggregated (and too limited in other respects) to be an adequate guide for policy purposes" at more localised scales; and van Kooten and Bulte (2000) arguing that the aggregated measure is a much less useful indicator of sustainability than the constituent parts.

These critiques have led to modification and improvements in EFA methodology (for example: Wackernagel and Yount 2000; Ferng 2001; Lenzen and Murray 2001; Wackernagel et al. 2004; Wackernagel et al. 2005; Venetoulis and Talberth 2005; Wiedmann et al. 2006); and EFA continues to grow in influence as a sustainability assessment approach. Its use in an urban development context is discussed in Chapter 5 of this thesis, and examined specifically in the context of MPE development in Chapter 6.

4.3 Implications for Research

Sustainability assessment mechanisms can be invoked in the operationalisation of sustainability principles in order to evaluate achievements against objectives and inform better decision-making. What emerges from the literature is significant support for, and commitment to, sustainability assessment, along with a diverse range of interpretations and approaches in practice, and limited consensus (Hacking and Guthrie 2008). As Bond and Morrison-Saunders (2011:2) point out, sustainability assessment is a young and emerging practice. They argue that while its use as a decision-making tool is "inherently a good thing", it must be recognised "that it is in the formative years of development". These authors thus highlight the need for research in this area to help

build rigour and capacity. This research, in its examination of particular cases of performance assessment relative to MPE development, aims to contribute to this formative development of sustainability assessment.

Reviewed above are several sustainability assessment methodologies with relevance to urban assessment. While existing assessment approaches such as EIA and SEA have been adapted to meet the needs of sustainability assessment (George 1999; Eggenberger and Partidario 2000), more common in the built environment sector is the use of indicator or criteria-based assessment frameworks, none more so than the ubiquitous 'triple bottom line' of environment, society and economy (Blair et al. 2003). In part as a critical response to this, others advocate a principles-led approach, focusing on defined sustainability principles as the bases for sustainability assessment (George 1999; Gibson 2000; Mawhinney 2002; Pope 2003; Gibson et al. 2005). As an alternative to both these mechanisms which are ultimately founded on a selective number of elements that attempt to represent sustainability objects, are systems-based approaches that attempt to measure the interaction between human activity and ecological systems.

Regardless of the methodological approach taken, any attempts to develop sustainability assessment tools should be informed by a number of key assessment principles that are evident in the literature. A basic and fundamental requirement is transparency of approach (Hardi and Zdan 1997). This applies to overall purpose and objectives, as well as to functional mechanisms, and processes of application. Such openness in method and process is critical to allow external scrutiny and therefore allow robust validation of assessment approaches (Roberts 2006). Also required is a clear articulation of objectives, and logical connectivity between those objectives and the functional dimensions of the assessment tool, facilitating internal consistency (Roberts 2006).

Sustainability assessment of urban development takes place in the context of extensive discourse on sustainability and sustainable urbanism. As such, tools that claim to facilitate sustainability assessment should be informed by, and held accountable to, key

sustainability principles and objectives (Newman 2004; Gibson et al. 2005). Further, the functional interpretation of sustainability in tools, as expressed via issue coverage, should be meaningfully derivative of sustainable urbanism objectives.

There are numerous methodological bases used for sustainability assessment. Regardless of approach, a clearly articulated methodology and transparent and justified means of measurement, prioritisation and aggregation are critical to provide rigorous assessment (Mawhinney 2002; Segnestam 2002). For assessment to effect significant and meaningful change, tools must also be practical in terms of resources required, relevant scale and scope of application, and ability to be integrated with development delivery processes (Hardi and Zdan 1997).

Further underscoring the importance of these principles is debate surrounding the subjective and objective dimensions of sustainability assessment. While an objective understanding of the impact of human activity has a key place in sustainability assessment (Hueting and Reijnders 2004), subjectivity exists both in the overall principles and purpose, and in the construction of assessment approaches through the selection of what to measure, how to measure and how to report results (Retzlaff 2009). Sustainability assessment is therefore a normative activity, built on subjective interpretations of environmental and social goals (Mawhinney 2002; Rametsteiner et al. 2011). As a result there is a tension between the technical and political dimensions of sustainability assessment. However, it is possible and desirable to recognise and manage this tension and subjectivity by making the process of decision-making clear and robust. The implications outlined above, along with those discussed at the end of Chapters 2 and 3 underpin the analytical framework used in this research to examine the case study tools. The following chapter outlines the framework, and the process of selecting case studies for detailed examination.

Chapter 5: Framework for Analysis

Introduction

This chapter shifts focus from discussion and critical review of concepts and approaches to the analysis of existing tools. It consists of two sections. The first section outlines the development of an analytical framework for application to the selected assessment tools, drawing on the literature previously discussed. The second section turns to existing practice, presenting a review of sustainability assessment approaches that are relevant to MPE development, and culminating in the selection of case study tools for further investigation.

5.1 Developing an Analytical Framework

This section presents the analytical framework developed to examine sustainability assessment tools that are targeted at MPE developments. As established in Chapter 1, this research utilises comparative case study methodology, seeking "exemplifying cases" of intrinsic relevance to the research questions and themes (Byrman 2004:51) with the development of an analytical framework used as the principal device for evaluating cases, following what George and Bennett (2005:68) refer to as the method of "structured, focused comparison" in case study research. The framework is structured as a series of characteristics required for effective sustainability assessment of MPEs; and as such, characteristics that are required for assessment to effectively catalyse change in development practice. The five characteristics are defined as openness; merit; worth; rigour; and practicality. The following discussion elaborates upon these characteristics, which are drawn from, and justified by, the preceding examination of urban development, sustainability discourse and sustainability assessment in Chapters 1-4. The framework is presented in summarised form in Table 4.

Openness

A recurrent and almost universal theme in the literature on sustainability assessment is the need for transparency and certainty of approach (Hardi & Zdan 1997; Hodge 1997; Newman 2004; Gibson et al. 2005). The first and most fundamental characteristic

considered in the examination of a tool, then, is its 'openness': the ease with which third party observers of the tool can access and examine the tool's approach and mechanisms; and the extent to which these are explicitly and unambiguously articulated. Openness can be considered fundamental to the integrity of an assessment approach, since it underpins the remaining four characteristics of the framework outlined below, enabling justification of the merit, worth, rigour and practicality of a given approach. Openness reduces the risk of ambiguity in interpretation and application, maximising the potential for consistent repeatability of assessment; and enables validation through external scrutiny (Roberts 2006).

Evidence of openness is sought through an examination of the availability and clarity of assessment tool documentation.

Merit

An examination of merit considers whether or not the subject of evaluation articulates clear objectives, and has the potential to deliver on those objectives – that is, whether it possesses internal consistency (Roberts 2006; Stufflebeam and Shinkfield 2007). Like openness, merit can be considered a basic but fundamental requirement, since an effective assessment approach must be able to demonstrate functionality that enables it to deliver on its own stated purpose and objectives.

Evidence of merit is sought through an examination of the following:

- clear statements of purpose and objectives; and
- logical connectivity between objectives and the functional components of the tools.

Worth

Merit alone is a limited indicator of a tool's value, since merit is framed in terms of objectives defined by the subject of evaluation. The concept of worth is therefore also used, in order to allow a more critical evaluation of the relationship between a tool and the context of its use. Assessment of worth considers the ability of the subject of investigation to meet broader relevant principles and objectives (Stufflebeam and Shinkfield 2007). As the research seeks to understand how

sustainability assessment tools can help to effectively implement sustainability principles in the delivery of MPEs, the case study tools are evaluated against key sustainability principles and objectives. This is particularly important given the diversity of approaches to sustainability and sustainability assessment and the contention and debate that currently surrounds them (Hardi and Zdan 1997; Roberts 2006).

An examination of worth in the context of sustainability assessment of MPEs considers whether or not tools provide a meaningful response to sustainability. Evidence of worth is therefore sought through identifying and analysing a tool's:

- engagement with sustainability principles; and
- coverage of sustainable urbanism issues.

To assess its engagement with sustainability principles, a tool's documentation is examined to identify references to, and definitions of, sustainability or sustainable development. Comparison is drawn with the literature on sustainability principles presented in Chapter 3, and in particular with the two fundamental principles presented in Table 1 – those of protecting, maintaining and enhancing ecological systems; and the meeting of human needs in an equitable way (WCED 1987; UNSD 1992; George 1999; Wackernagel and Yount 2000).

To assess issue coverage, a tool's functional metrics are examined and compared against sustainable urbanism objectives. This examination utilises the framework of objectives for operationalising sustainability in urban environments developed in Chapter 3 (Table 2). The metrics of the tools are deconstructed and then distributed against the objectives outlined in Table 2. This process aims to reveal the nature and extent of issues covered, and the de-facto issue prioritisation resulting from the inclusion and exclusion of particular issues.

Rigour

An examination of rigour considers engagement with sustainability assessment principles and methods, reflected in a clearly articulated assessment approach and

justified means of measurement, prioritisation and emphasis; and the existence of justified and unambiguous processes for tool development, application and continual improvement.

The various methodological approaches to sustainability assessment are outlined in Chapter 4. These include existing broader assessment methodologies such as EIA and SEA that have been adapted for use in sustainability assessment (George 1999; Eggenberger and Partidario 2000). More common in the assessment of the built environment though, is the use of indicator or criteria-based assessment frameworks, typically framed by the 'triple bottom line' of environment, society and economy (Blair et al. 2003), or aligned with defined sustainability principles such as inter-generational and intra-generational equity (George 1999; Gibson 2000; Gibson et al. 2005). Others utilise quantitative methods, attempting to measure the interaction between human activity and ecological systems.

All of these assessment approaches assign value and significance to measures through their metrics. In particular, the processes of weighting and aggregating allow priority to be allocated and evaluation data to be condensed, in order to better inform decision-making (Paracchini et al. 2008; Retzlaff 2009). These processes are necessarily subjective and have the potential to obscure data and introduce bias (George 1999; Todd et al. 2001; Mawhinney 2002; Segnestam 2002; Retzlaff 2009). It is therefore important that the methods of weighting and aggregation are clear, such that the appropriateness of the value bases and aggregation processes can be judged for use in a given context. Analysis of the assessment tools aims to identify and examine the methodological approaches of tools, including the methods of measurement, aggregation and prioritisation used.

Consistency in the use of tools is also critical for effective assessment. This is achieved through the establishment of a clear and unambiguous process of tool application, allowing for repeatability of assessment and confidence in the outcomes of assessment (Hardi and Zdan 1997; Roberts 2006). Finally, robust processes of development and ongoing improvement are also important. The actors involved in the development of a

tool, the decision-making processes involved, and the evidence used to inform those decision-making processes should all be evident and justified. It is also desirable that assessment approaches incorporate processes to evaluate their own effectiveness, to ensure that a tool is delivering on its objectives, that those objectives remain relevant, and that assessed performance translates into actual performance, resulting in meaningful change (Bond and Morrison-Saunders 2011; Rametsteiner et al. 2011). Such feedback mechanisms help to facilitate continual improvement of sustainability assessment approaches.

Evidence of rigour is sought through an examination of the following:

- the method of assessment used and the articulation of method compared to its theoretical foundations outlined in Chapter 4;
- the process of scoring through the measures used, and prioritisation through weighting and aggregation;
- the process of application; and
- the processes of tool development, evaluation of effectiveness, and continual improvement.

Practicality

An examination of practicality considers whether assessment tools are able to be used effectively within the context for which they are designed, and thus have effect in real world applications. This requires that the time and data and skill requirements are not too onerous, and ultimately, that the costs involved are limited and justified (Hardi and Zdan 1997). Practicality also benefits from effective integration with the existing policy and development delivery setting for MPEs, in particular that the scale and scope of application are evident and relevant to the delivery of MPEs. The concept of scale in this context refers to the scale of built form (Retzlaff 2008), while scope refers to the temporal scope of the tool's application across the different phases of development delivery – during planning and design; during project delivery; and/or after completion of development (Oliveira and Pinho 2010). (This should not be confused with issue scope, which is covered under 'worth').

Evidence of practicality is sought through an examination of the following:

- the resource requirements needed to implement the assessment approach; and
- the scale and scope of application.

Table 4 – Analytical framework – characteristics required for effective sustainability assessment of MPEs.

Openness:	The tool is transparent and unambiguous in approach.
Merit:	The tool has clearly defined objectives which align with the functional elements of the tool.
Worth:	The tool provides a meaningful response to sustainability in both engagement with sustainability principles; and coverage of sustainable urbanism objectives.
Rigour:	The tool observes and is derivative of sustainability assessment principles and methods with a clearly articulated assessment approach and justified means of measurement, prioritisation and aggregation; and has justified and unambiguous processes for tool application and continual improvement.
Practicality:	The tool is practical to implement and thus able to effect change.

5.2 Case Study Selection

This section considers existing assessment approaches with relevance to MPE development. As outlined in Chapter 1, the most relevant of these to the research questions and themes will then be selected for detailed interrogation. This will be done by developing selection criteria and applying these to the assessment approaches, resulting in cases of intrinsic interest being selected for detailed evaluation (Zartman 2005).

To date, initiatives aimed at detailed implementation and assessment of urban sustainability have been primarily targeted at the individual building scale (see for example Todd et al. 2001; Arup Sustainability 2004; Retzlaff 2008; Reed et al. 2009). Tools developed for use at this scale use a range of approaches to assessment, with varying scopes and coverage. In Australia, assessment tools such as Accurate and BASIX have been developed to evaluate the design and predicted performance of

proposed buildings, while the GBCA's 'Green Star' suite of tools include both predicted performance tools and 'as built' assessment tools. Other tools such as NABERS (the National Australian Built Environment Rating System) focus on evaluating the operational impacts of existing buildings using monitoring data. Further international examples of building scale tools include BREEAM (BRE Environmental Assessment Method) in the UK and the LEED (Leadership in Energy and Environmental Design) suite of tools in the United States. The growing use of these tools has resulted in significant progress in the environmental performance of the construction and operation of buildings.

The emergence of initiatives that facilitate the incorporation of sustainability principles into the planning and design of residential estate scale development – the scale at which this research is focused – is a more recent phenomenon. This is highlighted in a number of existing reviews of building scale tools which point to the growth in the development and use of neighbourhood scale tools, emerging from the more established field of building scale tools (Blair et al. 2003; Blair et al. 2004; Horne and Hurley 2006; Retzlaff 2008). Retzlaff (2008), for example, highlights the expansion of building scale tools into urban scale assessment in the United States, with the development of LEED – Neighborhood Development (LEED-ND) adding to the existing suite of LEED tools focused at the building scale.

The following discussion identifies relevant tools to this research, based on the tool's engagement with issues of sustainable urbanism and the tool's applicability to MPE development. It draws on research by Hurley and Horne (2006), Hurley et al. (2007), Fyfe et al. (2008), and Hurley (2009) who have identified those sustainability assessment tools with strongest relevance to the MPE scale of development. These include LEED-ND, AHURI sustainability indicators, VicUrban Sustainability Charter, Sustainable Community Rating, BEQUEST, EnviroDevelopment, Ecological Footprint Analysis (EFA), and the Precinct Planning and Design Standard. These tools are briefly introduced below, and then examined for relevance to the research focus in Table 5, culminating in the selection of specific cases for interrogation.

LEED-ND was developed in the United States by The United States Green Building Council (USGBC), in partnership with the Congress for the New Urbanism and the Natural Resources Defence Council (USGBC 2009). It is a voluntary and independent third party accreditation/certification tool for neighbourhood scale development, and follows the successful model of other LEED building assessment tools, such as LEED – Homes and LEED-New Construction (Commercial and Industrial).

The Sustainable Community Rating site of tools was developed by VicUrban, the Victorian Government's land development agency. The tools are based on the VicUrban Sustainability Charter, an assessment tool initially developed to ensure that VicUrban incorporated "measurable principles of economic, environmental and social sustainability" into its projects (VicUrban 2006:5). A process began in 2007 to develop the VicUrban Sustainability Charter into an assessment tool that had the potential to be used industry-wide, resulting in the re-named Sustainable Community Rating tools in December 2007. The result was three different variations of the VicUrban Chapter, one targeted at master planned communities, another at urban renewal, and a third at provincial projects. In this research the focus is on the Sustainable Community Rating – Master Planned Communities Tool (referred to in this research henceforth as MPCT).

BEQUEST (Building Environmental Quality Evaluation for Sustainability through Time) was a program conducted within the European Union from 1998 to 2001 to bring together knowledge and to gain new insights into the challenges of sustainable urban development resulting in a framework for sustainability assessment of urban development (Deakin et al. 2002; Deakin and Curwell 2004). The framework provides a useful tool to help decision-makers navigate the process of sustainable urban development and strategically examine the strengths, weaknesses and gaps in project proposals.

EnviroDevelopment, launched in 2006, was created by the Urban Development Industry Association Queensland branch (UDIA 2006). The motivation for the tool was the perceived need for an "an incentives-based framework to encourage and reward innovation in sustainable urban development", with the goal "ultimately to increase the

uptake of sustainable urban development" in Australia (Plant et al. 2006:309). The focus of EnviroDevelopment appears to be on engaging industry, creating non-regulatory, merit-based rewards, and encouraging best practice. It places emphasis on the importance of branding to create community awareness and consumer demand, thereby motivating developers to engage with the voluntary process. While its scope encompasses residential, retail, commercial, industrial and mixed-use developments, the majority of developments that have been assessed are residential estates.

The concept of ecological footprint analysis (EFA) has been introduced briefly in the literature preceding this discussion. The co-creators of the ecological footprint have highlighted many potential uses for the tool, and since its development it has been used in a diverse range of applications. Its use now stretches from global and national accounts, such as the World Wildlife Fund's Living Planet Reports (WWF, 2006), to regional, city, and local area scales (Aall and Norland 2002; Lyndhurst 2003; Collins et al. 2006; Collins and Flynn 2007). Australian examples include footprint calculations for Victoria and Melbourne (Global Footprint Network and The University of Sydney 2005), and New South Wales and Sydney (DEC 2006); and footprint calculations by local postcode area (ACF 2007). Increasingly it is being applied to project and product scales (for example Collins and Flynn 2005; Frey et al. 2006; Centre for Design at RMIT and Global Footprint Network 2006), with several ecological footprint studies of new suburb developments conducted in Australia: a study of the Aurora development in Melbourne, (Centre for Design at RMIT and Global Footprint Network 2006)[2]; and two studies of developments in Adelaide, Mawson Lakes (Fehring 2007) and Lochiel Park (Blaess et al. 2007).

The Australian Housing and Urban Research Institute (AHURI) has developed a TBL indicator framework for the performance assessment of estate scale development (Blair et al. 2003; 2004). The research involved applying the AHURI indicator suite to

[2] The ecological footprint analysis of Aurora was led by Tim Grant of the Centre for Design at RMIT. The author of this thesis (Joe Hurley) was a member of the research team on this project, during his PhD candidature. The experience of this project, along with the published results, informs the analysis of the use of Ecological Footprint Analysis in the context of urban development reported on in this thesis (primarily in Chapter 6).

existing suburbs in a comparative assessment of MPCs and Traditional Regulatory Subdivisions (TRSs), to test the hypothesis that MPCs show improved sustainability performance. Precinct Planning and Design Standard (PPDS) has been developed by a consortium led by the Sustainable Tourism Cooperative Research Centre, built in part on the AHURI assessment framework (Hyde et al. 2007). While focused primarily on tourism precinct development, it also aims to be applicable to mixed-use precinct development. The tool consists of an indicator framework and seeks to improve the planning and design of 'precinct' scale developments. It is presented as a design standard, to be used in the process of planning and designing new developments

Selection of cases

The purpose of the selection process is to select cases of intrinsic value with respect to the research focus for further interrogation. Following the methodology outlined in Chapter 1, selection criteria have been established to determine cases of most relevance. The criteria are as follows:

- Relevance to MPEs: tool has an explicit focus on MPEs, or documented evidence of its use in the assessment of MPEs.
- Relevance to Australian urban development: tool's structure, scope, and methodology make it applicable, or transferable, to an Australian urban development setting.
- Potential for improving sustainability outcomes: tool aims to directly affect decision-making in the delivery of MPEs.

The following seven tools have been evaluated against these selection criteria: AHURI Indicators; BEQUEST; Ecological Footprint Analysis; EnviroDevelopment; LEED – ND; PPDS; and VicUrban Sustainability Charter/MPCT. Each of the tools was qualitatively assessed for relevance, according to the three selection criteria above, and assigned a score of either low; low-medium; medium; medium-high; or high. These scores were then aggregated into an overall relevance rating for the tool. The results are presented in Table 5. Two tools, EnviroDevelopment and VicUrban Sustainability Charter/MPCT, achieved the highest relevance rating – both are Australian-based tools that are actively engaged in assessing MPE developments to affect decision-making in

their delivery. LEED-ND achieved a medium-high rating as, although it is targeted at the MPE scale of development, it is an American-based tool. However, given its connection with new urbanism, and the influence of new urbanism on MPE development in Australia (McManus 2005; James Hardy 2007), LEED-ND is considered a tool of particular interest to this research. Ecological Footprint Analysis also achieved a medium-high rating, as although it is a broad-ranging assessment methodology, with diverse fields of application, it is increasingly being used as a tool for assessing the performance of urban development, including MPEs. The AHURI Indicators and PPDS both achieved a medium relevance rating. They are both Australian focused tools, with relevance to MPE development. However, their relevance to the research was mitigated by their particular focus: PPDS with its primary focus on tourism precincts; and AHURI Indicators focusing only on ex-post assessment, and requiring an established community to generate necessary data. BEQUEST achieved low-medium and low relevance ratings respectively. While the framework is aimed at facilitating the incorporation of sustainability principles in decision-making processes for urban development, its broad approach and European focus lessen its relevance to the research.

Given these results, four tools were selected for detailed examination: the VicUrban Sustainability Charter/MPCT; Ecological Footprint Analysis; EnviroDevelopment and LEED-ND. Over the substantive period of data collection and analysis, 2007-2009, these four tools represent the most relevant and widely used sustainability assessment tools being used in the context of MPE delivery.

Table 5 – Evaluation of tools for case study selection.

Tool	Relevance to MPEs	Relevance to Australian urban development	Relevance to improving development outcomes	Overall Relevance
AHURI Indicators (Blair et al. 2003; 2004)	High relevance, specifically targeting MPE scale of development.	High relevance, developed in Australia, based on existing MPE and traditional subdivision development.	Low relevance, being focused only on ex-post assessment, and requiring an established community to generate necessary data.	**Medium:** An Australian sustainability framework targeted at both MPEs and traditional subdivisions. However, focus is on evaluating and ongoing monitoring of existing suburbs, and is therefore less relevant as a tool for use in the implementation phases of urban development.
BEQUEST (Deakin et al. 2002; Deakin and Curwell 2004)	Low-medium relevance, with a broad focus encompassing all forms of urban development.	Low relevance, developed in the European Union with little evidence of influence in Australian context.	Low-medium relevance, being a high level framework with broad scope, aimed at facilitating the incorporation of sustainability principles in decision-making.	**Low-medium**: This European framework has broad relevance to urban development processes, without being specifically focused on the residential estate scale of development.
Ecological Footprint Analysis (Wackernagel et al. 2005; Centre for Design at RMIT and Global Footprint Network 2006; Fehring 2007; Blaess et al. 2007	High relevance, as while it is a broad-ranging assessment methodology, there are several specific examples of tailoring for use in MPE assessment.	Medium-high relevance, with methodology used across many countries, including significant engagement in Australia.	Medium relevance, being used extensively in evaluation of existing circumstances; while increasingly being used to evaluate design alternatives, acting as a tool to aid front end decision-making.	**Medium-high:** Ecological Footprint Analysis is a broad framework, being applied in a huge diversity of applications. However, there have been several examples of EFA being applied to MPE development as an evaluation and decision-making tool in Australia.

Table 5 – Evaluation of tools for case study selection (continued).

Tool	Relevance to MPEs	Relevance to Australian urban development	Relevance to improving development outcomes	Overall Relevance
Enviro-Development (UDIA 2006; Plant et al. 2006)	High relevance, with the majority of cases assessed being residential estate development.	High relevance, being developed and applied in Australia by the UDIA.	High relevance, providing assessment that is focused at the planning and design stages of development delivery.	**High:** An Australian based sustainability assessment tool that presents list of criteria as standards that a developer must meet to achieve certification, thereby aiming to improve development outcomes.
LEED – ND (USGBC 2009)	High relevance, specifically targeting estate scale of development.	Medium relevance, being developed in the United States but with influence on the MPE development sector in Australia.	High relevance, providing assessment and accreditation of development at both planning and design stage, and after development delivery.	**Medium-high**: An influential tool, and although based in the US, both the tool, and its new urbanist focus have a significant influence on the Australian urban development sector.
PPDS (Hyde et al. 2007)	Low-medium relevance with a strong focus on tourism developments, although can encompass mixed-use development.	Medium-high relevance, developed in Australia, however, primary focus on tourism sector.	Medium-high relevance with a strong focus on improving development outcomes in the tourism precinct development.	**Medium**: Offers precinct scale sustainability assessment, but with a strong focus on tourism developments.
VicUrban Sustainability Charter / MPCT (VicUrban 2006; SCR 2011)	High relevance, specifically targeting MPE scale of development	High relevance, developed by Victorian government land development agency, with a focus on providing industry wide applicability.	High relevance, providing assessment applicable throughout the design and delivery of projects, thereby aiming to improve development outcomes.	**High:** MPCT is an Australian sustainability framework for precinct scale development, based primarily on residential estate development.

Chapter 6: Analysing Tools

Introduction

Focus now turns to a detailed analysis of the four assessment tools identified in the previous chapter as most relevant to this research inquiry: EnviroDevelopment; VicUrban Sustainability Charter / MPCT; LEED-ND; and Ecological Footprint Analysis. Each of the four assessment approaches is presented in turn, with the analytical framework developed in Chapter 5 used to structure the analysis.

The chapter deals first with the three criteria-based assessment tools: EnviroDevelopment; VicUrban Sustainability Charter / MPCT; and LEED-ND. The last tool considered is Ecological Footprint Analysis which differs substantially in methodological approach from the first three tools.

6.1 EnviroDevelopment

EnviroDevelopment is an assessment tool used for the certification of urban development projects in Australia. It has been developed by the Urban Development Industry Association Queensland branch (UDIA 2006), and continues to be administered by the UDIA. It is a voluntary certification tool and provides certification to developers in six areas: Ecosystems; Waste; Energy, Materials; Water; and Community. The published EnviroDevelopment standards inform this analysis, along with EnviroDevelopment promotional material and other UDIA related material. The first full version of EnviroDevelopment was released in Queensland in 2006 (version 1.1) (UDIA 2006). In 2009, UDIA launched slightly modified versions of the original Queensland standards in South Australia and Western Australia, with standards for Victoria and the ACT released in 2010. Also released in late 2009 was an updated version of the Queensland standard (version 2.0) (UDIA 2009a).

This analysis focuses on the original Queensland version 1.1 standard (UDIA 2006) however it also highlights areas where the newly released version 2.0 standard differs from the earlier standard. EnviroDevelopment remains an active assessment tool, with

the UDIA extending its reach across Australia with modified and updated versions. As at January 2011 there were 24 developments listed on the EnviroDevelopment website as accredited EnviroDevelopments, with 10 of these in Queensland, six in South Australia, four in Western Australia, two in Victoria, and one each in New South Wales and the Australian Capital Territory (UDIA 2010b).

Openness

The EnviroDevelopment standards are all available for download in full from the UDIA website (UDIA 2010b). The standards document the criteria used for assessment, and provide detail of material required to evidence performance against criteria. However, the determination of performance against these criteria is a closed process carried out by UDIA's EnviroDevelopment Board. The documentation of assessment criteria, while available, is often broadly specified (discussed in further detail below), leaving it unclear as to what must be achieved to meet a given criterion.

The tool and its criteria were developed though a committee-based process, drawing on research, expert input and stakeholder engagement. Documentation on the membership of the tool development committee is not publicly available, nor is the process of determining assessment criteria. The combination of broadly defined criteria open to interpretation with a closed assessment process limits the ability to examine and validate the application of EnviroDevelopment.

Merit

EnviroDevelopment makes clear statements regarding its purpose: "EnviroDevelopment has been created to increase the uptake of sustainability in all aspects of development", and in doing so its "purpose is to mainstream more sustainable development" (UDIA 2006:2). It therefore explicitly refers to sustainability and sustainable development as underpining the objectives of the tool. The motivation for EnviroDevelopment was the perceived need for "an incentives-based framework to encourage and reward innovation in sustainable urban development" (Plant et al. 2006:309).

In delivering on this purpose, the EnviroDevelopment framework is divided into six categories, referred to as 'elements': ecosystems; waste; energy; materials; water; and community. Each element area presents an objective and target, as outlined in Table 6 below. The tool thus offers clear statements of objectives with some targets specified to create measurable objectives. However, the clarity of objectives and targets, and therefore understanding of what would constitute success against objectives, varies between the elements.

Table 6 – EnviroDevelopment objectives and targets.

Element	Objective	Target
Ecosystems	Healthy, sustainable ecosystems based on natural processes and rich with native biodiversity	Development that aims to protect and enhance existing native ecosystems and encourages natural systems and native biodiversity and rehabilitates degraded sites.
Waste	Reduced waste sent to landfill, more efficient use of resources.	Development that has implemented waste management procedures and practices which reduce the amount of waste to landfill and facilitates recycling.
Energy	Reduced usage of polluting and non-renewable energy sources	Measures that would achieve 40% reduction in GHG production from energy use across the development (compared to recent historical data and/or 'traditional' development meeting basic regulatory standards).
Materials	Environmentally responsible material usage	Development that predominantly utilises environmentally responsible materials to lower environmental impacts in preference to other materials when such options are available and feasible, without significantly jeopardising the functionality or liveability of the development.
Water	Improve water use efficiency	Measures that would achieve 40% reduction in potable water use across the development (compared to recent historical data and/or 'traditional' development meeting basic regulatory standards).
Community	Vibrant, cohesive, healthy, happy, adaptable, sustainable communities	Development that encourages community spirit, sustainable local facilities, reduced use of private motor vehicles and accessible and flexible design that welcomes a diversity of people and adapts to their changing needs.

(UDIA 2006)

The Energy and Water objectives, for example, present measurable targets, both requiring a 40% reduction of resource use from a baseline figure. The remaining objectives do make their intent clear, pointing to the outcomes required to meet objectives, but do not offer measurable targets. The Ecosystems element provides a clear qualitative indication of intent, with the target to "protect and enhance existing native ecosystems and … [rehabilitate] degraded sites"; however, a measurable target is lacking. With both the Waste and Materials elements no measurable targets are provided, and the wording is such that the extent of change required to deliver outcomes is unclear. The target for Waste to "reduce the amount of waste to landfill and [facilitate] recycling" could be achieved with minor commitment and without any significant reduction of waste to landfill. Similarly, the target for Materials calls for "predominant" use of environmentally responsible materials, but also provides several caveats regarding availability and feasibility. The Community objective is the most general in language and apparent intent. It appears to be a catch-all for any remaining objectives that the tool's developers wished to encapsulate, covering a raft of issues across liveability, urban design, mobility, social inclusion and adaptability. This makes the intentions of the objective unclear, except in very general terms; and the lack of measurable targets means that the extent of outcomes required to deliver on the objective is not apparent.

The connectivity between objectives of the tool and the functional measurement criteria is transparent and logical, with criteria organised under each element area. The lack of specific requirements for meeting criteria is therefore ameliorated to some extent via more specific and measurable targets in each criterion, although the actions required to meet individual criteria are also often not evident. A detailed analysis of these element areas and their individual criteria is provided in the Worth section below.

Both the South Australia and Western Australia standards, released in 2009, adopt the same objectives and targets listed above. The 2009 version 2.0 Queensland standards introduce two significant changes: increasing the GHG reduction requirement from 40% to 45%, and water use reduction requirements from 40% to 55%.

Worth

EnviroDevelopment clearly appeals to sustainability in its articulation of purpose and objectives, as identified above. Indeed, the six elements of the tool are referred to by the UDIA as the "six signs of sustainability" (UDIA n.d.)). Further, part of the declared intent of EnviroDevelopment is "to clarify the issue of sustainability in developments for local governments and consumers" (Plant et al. 2006:309). UDIA is the peak body for the urban development industry in Australia and has the role of advocating on behalf of the interests of developers. As such, the intent to 'clarify' sustainability in urban development points to the importance for the development sector of setting the agenda for the interpretation of sustainability in an urban development context. Despite the tool's stated aims of increasing "the uptake of sustainability" and of "mainstream[ing] more sustainable development" (UDIA 2006:2), the framework contains scant further elaboration on sustainability concepts. The tool provides no clear definition of sustainability, or the interpretation of sustainability in its specific context. There is no overt discussion of sustainability principles and how they have informed the tool's development. This is a weakness in the theoretical justification of the tool. In the absence of any clarification on the interpretation of sustainability, judging how the tool responds to sustainability fundamentals requires careful examination of the six elements and the criteria they are comprised of, to try and identify connection with sustainability principles and the significance allocated to them.

Five of the six elements of EnviroDevelopment centre on protecting ecological systems and reducing resource use and waste/pollution, suggesting that the tool has a focus on ecological concerns. While not made explicit, this is derivative of the principle of inter-generational equity, with its focus on protecting and enhancing ecological systems such that future generations are not disadvantaged by current actions. And while the framework doesn't explicitly engage with the concept of ecological limits, each element has a target statement attached (see Table 6), with the Water and Energy elements actually including a measurable target. EnviroDevelopment is weaker in its engagement of the socio-economic dimensions of sustainability, with relevant criteria concentrated in the Community element of the tool, and covering a broad spectrum of issues under

the headings of consultation; transport; community design; local facilities; safe, accessible housing; and indoor environmental quality.

Table 7 below presents detailed analysis of the coverage of issues in EnviroDevelopment, against the list of objectives for operationalising sustainability in urban environments developed in Chapter 3 (see Table 2). The examination of issue coverage includes a calculation of the proportion of the tool devoted to each issue as represented by the criteria in the tool, and the prioritisation attached to criteria (based on Queensland version 1.1). The allocation of proportion of issue focus is calculated as follows:

- Each of the six element areas are allocated 1/6 of the tool's proportional emphasis, as a development can be accredited in each element area separately, and there is no weighting between elements.
- Each element is made up of a set of headline criteria, which in turn are made up of detailed functional criteria that need to be met to achieve the headline criteria. The headline criteria are all weighted equally, and therefore proportional emphasis is equally distributed across each of the headline criteria within a section. Within the headline criteria emphasis is further allocated based on the number of functional criteria focused on a particular issue, as a proportion of the number of functional criteria listed under the headline criteria.

Example Calculation: Determining the issue focus of 'provision of affordable housing':

- There are two functional criteria in EnviroDevelopment that relate to the provision of affordable housing, 6.6.4 and 6.6.5.
- These criteria form part of the Community Design headline criteria which is one of six within the Community element of EnviroDevelopment. The Community Design headline criteria contains 13 functional criteria.
- Therefore the proportion of EnviroDevelopment focused on provision of affordable housing is: 2/13 of the Community Design headline criteria; which is 1/6 of the Community element; which is 1/6 of the overall focus of EnviroDevelopment. = 2/13 x 1/6 x 1/6 = 0.4%

Table 7 – EnviroDevelopment issue coverage.

Issue	Objective	Criteria	Proportion
Energy consumption and GHG emissions	Direct – Reduce energy (electricity and gas) consumption and/or replace with renewable energy (solar/wind/accredited green power); or eliminate/offset GHG emissions.	3.1.1 - 3.1.5; 3.2	**17%**
	Indirect – Increase mode share of public transport to reduce use of fossil fuel intensive transport.	6.3	**1%**
	Indirect – Increase viability of walking and cycling to reduce use of fossil fuel intensive transport.	6.3	**1%**
	Indirect – Reduce distance required to travel by providing or locating near services and employment.	6.3; 6.5	**4%**
Water cycle impacts	Reduce water consumption.	5.2	**17%**
	Improve stormwater management – improve water quality, reduce quantity.	1.2.1 – 1.2.8	**4%**
	Protect and rehabilitate natural waterways.		
Materials and solid waste	Increase use of ecologically preferable materials.	4.2; 4.3; 4.4	**13%**
	Reduce solid waste impacts.	2.2; 2.3; 2.4; 4.5	**21%**
Biodiversity and ecology	Protect local bioproductive land, biodiversity and ecology.	1.3; 1.4; 1.5	**13%**
Increase quality of life	Community development.	6.4	**1%**
	Provision of safe urban environments.	6.6; 6.7	**6%**
Increase equality	Provision of affordable housing.	6.4	**<1%**
	Community consultation.	6.2	**3%**
Other areas of significant focus (>2% of tools focus)	None	-	-

The analysis of issue coverage reveals the tool's substantial focus on reducing energy consumption (17% of the tool's overall focus). While several of the criteria deal with the specific issues of solar orientation, passive design, energy efficient lighting and air-conditioning, the central criterion with regard to reducing energy consumption is the mandatory target of 40% reduction of GHG emissions from energy use across the development, "compared to recent historical data and/or 'traditional' development meeting basic regulatory standards" (UDIA 2006:18). The standards offered an example of traditional development energy use of 8,824kWh per annum per household, citing a Queensland Government Regulatory impact statement as the source. The reduction target has been raised to 45% in the Queensland version 2.0. The primary means outlined to meet this criterion is:

- The provision of a renewable or more efficient energy supply; or
- The implementation of building energy efficiency measures, such as "insulation, cross-ventilation, eaves, enhanced natural lighting, very low energy water heating, solar powered room heating and cooling (e.g. solar powered fans), 100% energy efficient lighting, design for passive climate control" (UDIA 2006:20).

To assess compliance with the 40% GHG reduction target, an Energy Efficient Checklist is provided. Despite the disclaimer that the checklist is "based on a number of assumptions and should be used as a guide only" (UDIA 2006:21), it is listed as one of the three acceptable ways of demonstrating compliance. Given that the other two ways to demonstrate compliance involve the more costly and onerous options of either providing evidence from an energy rating tool such as NatHers or Accurate, or evidence of energy savings provided by an engineer, the checklist becomes the most appealing option in seeking accreditation, and therefore by default ends up defining the specific requirements to comply with this criteria.

The tool has a negligible focus on the availability and use of public transport or walking and cycling (both constitute 1% of the tool's overall focus). The only criterion addressing public transport, and the only criterion addressing improved cycling and walking, are under the Transport headline criteria within the Community Development element. Along with these two criteria, is a criterion addressing the provision on pathways and one addressing working from home. Only two of these four criteria under

Transport headline criteria must be met. Therefore development can easily meet the Community element without having any provision for, or consideration of, public transport. This means that a development can become a fully accredited EnviroDevelopment (meeting all of the six elements) while still being entirely dependent on private car travel to meet mobility needs. Given that private car travel makes a significant contribution to urban GHG emissions, reduced dependence on the private car is a mainstay of sustainable urbanism objectives evident in the literature (Newman and Kenworthy 1999). Therefore this omission would seem a substantial concession to status quo development in the tool.

The tool has a number of measures focused on the proximity of local services (4% of the tool's overall focus), with the majority of this focus via criterion 6.5 – Local Facilities. This criterion requires 75% of the development's dwellings to be within 2kms of local services. A list of 19 local services is provided, of which at least five must meet the proximity criterion. Achieving just five of 19 local services makes the hurdle mark for this criterion very low. Examples of local services include: grocery/corner store; parks and open space; bank or cash machine; primary school; kindergarten, preschool or childcare; playground and/or recreational facilities; and information exchange medium (e.g. community notice board, newsletter, or website). Therefore this criterion could be met by a traditional subdivision on a major arterial road, with a petrol station/convenience store (complete with community notice board and cash machine), and some local open space with a playground. The low hurdle mark and high level of flexibility here means that current standard practice can easily meet the criterion, and so the tool does little to encourage (or require) a level of increased self-containment which would be necessary to "reduce use of private motor vehicles" as stipulated in the target for the Community element (UDIA 2006:32).

The tool has a substantial focus on reducing water consumption (17% of the tool's overall focus). The central criterion of this issue focus is the mandatory target of a 40% reduction in potable water use across the development (5.2). (This reduction target has been raised to 55% in the Queensland version 2.0 standards). In addition to water conservation, the tool has a number of measures focused on improved stormwater

management (4% of the tool's overall focus), with the protection and restoration of natural waterways covered by the mandatory water quality criterion (1.2) in the Ecosystem element.

As with the focus on energy discussed above, water reductions are to be achieved from a baseline figure based on traditional water use, given as 820 litres per household per day. The accepted means to achieve this reduction in potable water use include: stormwater harvesting; use of recycled water; direct greywater reuse; roof rainwater harvesting; use of underground water source; and building and landscape efficiency measures. As with energy, to assess compliance with the 40% water reduction target, a Water Efficient Checklist is provided. Again a disclaimer is provided stating that the checklist is "based on a number of assumptions and should be used as a guide only" (UDIA 2006:30), yet the checklist is accepted as a means of demonstrating compliance, and far less onerous than the other option of providing certified evidence of professional water cycle modelling. The inclusion of the "sustainable use of underground water source" to offset potable water consumption is of potential concern here, as there are potentially significant environmental impacts associated with extensive groundwater extraction and use (Morton et al. 2009). It is conceivable under this criterion that a golf links estate that achieves a 40% reduction in water use across the development by using groundwater to irrigate the golf course, could be accredited against the water element without any water saving initiatives needing to be implemented to housing stock or other buildings.

Issues relating to materials and solid waste receive significant attention in EnviroDevelopment. The tool has a substantial focus on the use of eco-preferable materials (13% of the tool's overall focus) with criteria that cover the use of environmentally responsible materials; non-toxic materials; and local products. The subject of EnviroDevelopment that receives the highest proportion of the tools attention, though, is the management of solid waste (21% of the tool's overall focus). The majority of measures addressing this issue are focused on actions during the construction phase of the development. There is only one post-construction criterion, although it is compulsory. This prioritisation of construction waste appears to be based

more on the ability of a developer to affect this outcome, than the significance of environmental impact from such activities. The one criterion affecting ongoing waste management requires securing curbside recycling for the development (but only if the recycling facility is within feasible distance – 20km is suggested as feasible) and the provision of one of the following two options: provision of composting facilities, or collection of green waste. These are the only measures that affect the ongoing ability of residents to reduce impact through waste management practices. They are limited in scope and significance, reflecting the majority of current practice, and do not require or even encourage leadership or innovation.

The use of measures relating to the protection of existing ecology and biodiversity also constitutes a substantial focus of the tool (13% of the tool's overall focus). There is a mandatory requirement to conduct ecological assessment of the development site and to develop mitigation strategies to protect flora and fauna, with 10 of 13 flora criteria to be met, and 10 of 14 fauna criteria to be met. Examples of criteria include:

- 40% use of endemic plants in planting
- Protection and rehabilitation of significant areas
- Retain at least 40% of existing native trees above three meters
- Retain and enhance ecological corridors
- Increase in green space (as nature conservation areas) of 20% above legislative requirements.

Given the compulsory nature of the Flora headline criteria, and the high proportion of the component criteria needing to be met to satisfy the headline criteria, the focus on ecology and biodiversity in EnviroDevelopment is both substantial in content, and significant in requirements for certification.

Within the Community element of EnviroDevelopment there is significant focus on the provision of safe urban environments (6% of the tool's overall focus), based on providing indoor air quality and disability access. There is also limited focus on community development (1% of the tool's overall focus) and community consultation (3% of the tool's overall focus). The tool has a negligible focus on housing affordability (less than 1% of the tool's overall focus). The two housing affordability

criteria specified are reasonably well articulated and significant in their requirements, with one requiring at least 10% affordable housing (affordability defined as housing less than 70% of the median price of all the other houses or blocks of land in the development), and the other requiring significant diversity of housing types. However, the criteria make up two of 13 criteria listed under the 'Community Design' headline criteria in the Community element, of which only six must be achieved to meet requirements for certification in this element. Therefore, there is a significant flexibility as to what issues will achieve attention. For example, a development could easily achieve accreditation against the Community Element without any attention to housing mix or affordability. This flexibility makes it difficult to determine what EnviroDevelopment envisions the social dimension of sustainability in MPEs should entail. An advertorial spread in *The Australian* newspaper highlights this confusion, with an article discussing the merits of EnviroDevelopment explaining the Community element of the certification tool as representing:

> the most forward-looking projects [which] try to build in a way to promote social interaction. These will not be gated communities, where people lock themselves away, but thriving villages with shared facilities and a common ethos (*The Australian*, Friday March 2, 2007 p31).

On the same page, an advertisement for Mebbin Springs, a fully accredited EnviroDevelopment across all six elements, proudly presents their "residential acreage" as a "gated community", with "435 acres and only 66 families to share it" (Advertisement – *The Australian*, Friday 2 March 2007 p31). Further, on the UDIA website Mebbin Springs is identified as "setting new benchmarks in sustainability … a fully sustainable energy-efficient gated community" (UDIA 2010a). While there are many progressive elements to the environmental performance of houses at Mebbin Springs, it is clear that not even the developer believes they are producing an open and inclusive community, or believes that efficient use of land in an urban development context is an objective to strive for. On both environmental and social sustainability grounds the development has clear short-comings, yet is able, thanks to the endorsement of EnviroDevelopment, to claim it is "fully sustainable".

Rigour

The assessment methodology for EnviroDevelopment is criteria-based assessment. It presents lists of criteria, grouped under headings, for developers to consider as part of any certification process. By grouping the assessment criteria into categories the tool conforms with a 'domains' conception of sustainability. The domains approach is dominated by the TBL interpretation of sustainability, based on an integrated approach to economic, social and environmental issues. EnviroDevelopment invokes TBL as an organising framework, stating that while the six elements of the tool focus on "environmental and community sustainability issues" it represents a "triple bottom line" approach, as "economic impacts have been considered and integrated into the standards and will also be considered by developers on a case-by-case basis in their choice of environmental solutions" (UDIA 2006:2). However, with five of the six elements focused on environmental issues the tool has a clear issue focus on the environmental domain over the social and economic.

Each of the element areas in EnviroDevelopment consist of lists of assessment criteria. In order to achieve certification in an element area, a project must meet the requirements of criteria that are deemed 'essential actions'. In addition, a project must satisfy a specified proportion of other criteria within that element area. Therefore the essential actions are compulsory criteria, while all other criteria have a degree of flexibility, with the applicant able to decide which of the criteria to focus compliance efforts on to meet the certification requirements. For example, within the Waste element under the Construction Phase headline criteria, there are 10 functional criteria presented, with the requirement that at least four are to be met (UDIA 2006:17). In the EnviroDevelopment certification framework, developments can be accredited in one, several, or all of the six element areas. Whilst this may increase the likelihood that more developers may engage with the certification process, it also could encourage the 'pick and choose' mentality that pervades domain-based criteria frameworks.

EnviroDevelopment does not use an overt scoring mechanism to give weighting to the different issues covered, or criteria presented. There are, however, several ways in which prioritisation is exercised. The first method for prioritisation lies in the domains

approach to criteria and the establishment of the six elements of certification. The selection of these six element areas elevates these particular issues as the broad areas of priority for the tool. As each element is accredited separately, there is no possibility of trading off criteria between sections, giving each of the six elements equal weighting. Secondly, significant prioritisation occurs via the criteria nominated under each element area, through the coverage or exclusion of issues. The third level of prioritisation is via the use of the mandatory essential actions. The 2009 version 2.0 Queensland standards introduces an overall list of 'essential requirements' for the tool which an applicant needs to comply with in order to achieve certification in any of the six element areas. This presents a further opportunity for prioritisation, with the criteria listed here elevated in importance, requiring a base level of performance in certain areas to achieve EnviroDevelopment certification. Finally, prioritisation is affected by the degree of flexibility provided through the lists of optional criteria. For example, a section that contains 10 criteria, with the requirement to meet four, has more flexibility than a section containing 10 criteria, with the requirement to meet eight. The latter example is effectively assigned higher importance and priority as it possesses stricter requirements to achieve certification. While prioritisation of issues is clearly exercised in the EnviroDevelopment tool, the reasoning behind this prioritisation is not made apparent anywhere in the tool or supporting documentation.

The tool outlines a systematic process for the application of the criteria (UDIA 2006:3). A developer must prepare an application form, with detailed supporting documentation, in response to the lists of criteria in the tool. An application fee is also levied at this stage. The application is then reviewed by the UDIA EnviroDevelopment Board of Management, with further information sought from the applicant if needed. The board then awards provisional certification if the development approval process is yet to be completed with the relevant planning authority, which is upgraded to full certification once development approval is granted. The developer is licensed to use the EnviroDevelopment certification for 12 months. The evaluation of applications and the provision of certification is a closed process, managed by the EnviroDevelopment Board of Management. Plant et al. (2006:310) declare that the Board, which is "responsible for overseeing the certification process ... consists of small, medium and

large-scale developers, lawyers, consultants, with Foundation Partners and Supporting Organisations also present as observers"; however, the actual membership of the Board is not publicly available. The process lacks transparency, with evaluation ultimately at the discretion of the Board of Management and not open to external scrutiny. This lack of transparency results in a significant weakness in the method of assessment, leaving it open to subjective interpretation, therefore making repetition of assessment (for the same outcome) difficult within the closed process, and nearly impossible by a third party. This has major implications for the accountability of the assessment process.

The tool and its criteria were developed though a committee-based process, drawing on research, expert input and stakeholder engagement. This committee-led approach is common in criteria-based assessment tools. The committee or "Technical Standards Taskforce" included "representatives from developers, consultants and state and local government", with the resulting development of standards "supported by analysis using the best research available at the time and the scrutiny of professionals in the field" (Plant et al. 2006:309). However, the list of members of the Technical Standards Taskforce is not publicly available, nor is an explanation of the specific inputs from these experts or stakeholders, or how this input was dealt with in the development process.

Plant et al comment that it is "intended that the [EnviroDevelopment] standards be raised over time" (2006:311). While there is no clear process outlined for how and to what degree standards may be developed over time, the second version of the Queensland standards was released in late 2009, demonstrating this commitment to ongoing improvement. As discussed above, the revised standards included some changes to targets, most notably in the Energy and Water elements. There is, however, no documented process for evaluating the impacts of developments accredited under the EnviroDevelopment standards, and no explanation of how any evaluation, if carried out, has informed the revised standards. As such, commitment to continual improvement is undermined through a lack of clear motivation and justification of changes.

Practicality

Part of the motivation for EnviroDevelopment is the need to provide interpretations of sustainability for the urban development industry that can be "implemented swiftly and not cause an excessive burden on industry, government or certifiers", as it is argued that "such burdens, whether in paperwork, time delays or financial costs, would be significant disincentives and a cost to the broader economy" (Plant et al. 2006:309). The certification process aims to utilise where possible the type of information that must be collated for regulatory approval processes in order to avoid excessive burden on developers (Plant et al. 2006). Standards are set "substantially higher than standard practice and regulation", at levels that the top 10-20% of developers are already achieving, to encourage engagement, and make certification accessible to the majority of the development industry (Plant et al. 2006:310). In developing the criteria, the taskforce was "mindful of not setting the standards too high so they would not be perceived as too difficult or expensive to attempt compliance" (Plant et al. 2006:310).

While the types of development targeted by the tool are not explicitly stated, it is apparent from its objectives and criteria that the tool is focused at estate scale development, in particular MPEs, with several criteria requiring evidence of integrated master planning. The nature of criteria point to a focus on greenfield development, although there are a number of criteria that reward the use of brownfield sites, and the majority of developments accredited on the EnviroDevelopment website are greenfield MPEs (UDIA 2010b). Assessment of developments occur at any point in the development process that the developer feels the needs of assessment criteria can be met; however, this is envisaged to happen at the same time as the development approval process, as a primary purpose of certification is to provide branding for the development during the selling phase. Certification is then valid for 12 months and can renewed so long as the development continues to meet the certification criteria.

Summary

EnviroDevelopment embraces the language of sustainability to articulate its purpose and justify its objectives. It does not, however, clearly communicate how the principles of sustainability have been interpreted, or how these in turn inform the development of the

tool. As such, it is the actions and requirements stipulated in each of the tool's assessment criteria that define how sustainability has been interpreted. This reverse engineered approach sees the tool's actions inform its principles, rather than the other way around. By neglecting to adopt or even acknowledge and discuss any more broadly accepted definitions and principles of sustainability, UDIA attempts to set its own agenda for the interpretation of sustainability in an Australian urban development context.

The tool uses a criteria-based assessment approach developed through an opaque committee-based process, with information on the decision-making processes and actors involved unavailable for external scrutiny. Based on the assessment criteria provided, the tool has a strong focus on environmental impact reduction, particularly on reduction of GHG emissions, solid waste (in construction), and water consumption. The tool has little focus on equity issues such as catering for diversity and affordability, with only a few optional measures under the Community Design headline criteria.

The standards the tool ascribes are incremental, extending current practice. In some areas these standards require significant action, while in others they only marginally extend current practice. The generic wording of some objectives and targets, the subjective and flexible nature of many criteria, and the closed process for evaluating applications make it unclear what a development must achieve to be accredited by EnviroDevelopment, and therefore it is not clear how significant the performance of an accredited development is compared with standard practice. The ongoing management and application of the tool is conducted by UDIA's EnviroDevelopment Board, and involves closed processes which ultimately affect the accountability of the assessment process.

6.2 VicUrban Sustainability Charter and Sustainability Community Rating

The Sustainability Charter and Sustainability Community Rating are initiatives of VicUrban, the Victorian Government's land development agency. The agency is governed by the VicUrban Act (State of Victoria 2003) and is charged with

implementing Victorian government policy through its urban development projects. However, as a corporatised government agency, VicUrban must also deliver urban development projects within a commercial marketplace. VicUrban has played an active role in developing and using sustainability assessment tools for urban development.

In 2006, VicUrban launched the VicUrban Sustainability Charter, a sustainability assessment tool targeted at the estate scale of development. The Charter consists of performance measure tables framed by a detailed presentation of objectives, purpose, and application process. In late 2007, VicUrban launched the Sustainability Community Rating suite of tools, based on the performance measure tables established in the Sustainability Charter, in an effort to encourage wider uptake of the tools in the urban development industry. Sustainable Community Rating consists of three similar tools: the Master Planned Community Assessment Tool (referred to here as MPCT), the Urban Renewal Community Assessment Tool; and the Provincial Community Assessment Tool. The MPCT is essentially a stripped-back version of the VicUrban Sustainability Charter, containing the performance measure tables and a summarised presentation of objectives; while the other two tools have modified criteria to account for their particular applications. In 2009, primary responsibility for the development and implementation of the Sustainable Community Rating tools was handed over to the Green Building Council of Australia (GBCA) in order to further enhance its industry-wide applicability (GBCA 2009). In 2010, GBCA launched the framework for 'Green Star Communities' which builds on the work of VicUrban and will eventually supersede the MPCT (GBCA 2011). With Green Star Communities currently still under development, the MPCT continues to be an active assessment tool, available on the Sustainable Community Rating website (SCR 2011), and therefore most relevant to this research. While the VicUrban Sustainability Charter is no longer actively used, it remains available on the VicUrban website (VicUrban 2011).

The analysis in this research covers both the MPCT (SCR 2011) and the VicUrban Sustainability Charter (VicUrban 2006), with the primary focus on the more recently developed MPCT, and its broader industry focus. Consideration is also given to the progression from the Charter to the MPCT, highlighting instances where the MPCT

differs significantly from the Charter. The VicUrban Sustainability Charter and the MPCT together provide a comprehensive understanding of VicUrban's approach to assessing sustainability in MPEs.

Openness

The MPCT performance measure tables are all available for download in full form on the Sustainable Community Rating website (SCR 2011). Also documented is the associated scoring system based on the allocation of points against each criteria. However, as discussed below, determination of the requirements of criteria is often unclear. There is no publicly available documentation of the process of determining the assessment criteria of MPCT.

Merit

MPCT is presented with the aim of "provid[ing] developers of new communities with a common language and framework to assist them in the planning and delivery of sustainable communities", and is based on performance measure tables which "aim to identify best practice for the development of new communities" (SCR 2009). The earlier Sustainability Charter has a similar focus on aiding engagement with sustainability in the delivery of projects, with the claim that the Charter "demonstrates leadership and a new direction to drive sustainability outcomes in the built environment, and for the property and development industry to measure and report on sustainability" (VicUrban 2006:3). The tools explicitly adopt the language of sustainability, and aspire to set the agenda for 'best practice' across this development sector. The purpose of both tools is thus to provide frameworks to interpret and apply sustainability in the context of MPE development.

Both the Charter and MPCT outline five core objectives which are drawn directly from the five organisational objectives of VicUrban: commercial success; community well-being; environmental leadership; urban design excellence; and housing affordability. Table 8 presents these objectives in more detailed form, as documented in the MPCT. An examination of these objectives reveals a lack of clarity and consistency. The Urban Design Excellence objective, for example, points to a focus on "creating a sense of

place", but provides no further explanation or interpretation of what this might entail. The Housing Affordability objective is similarly vague, offering only that it is a 'critical' issue. The Community Well-being and Environmental Leadership objectives offer more clarity, detailing requirements to meet the objectives, such as having "access to services, jobs and learning", and "protection … of natural systems", though little indication is given as to what actions would be required to deliver on each objective. The Commercial Success objective is the only one that clearly articulates the outcome required to achieve that objective, with all projects required to meet or exceed an economic hurdle return rate. So, while MPCT and the Charter have identifiable statements of purpose and objectives, most are provided without clear intent or direction.

Table 8 – Charter and MPCT objectives.

Community Well-being	The Community Well-being objective aims to deliver communities that are safe, healthy; have access to services, jobs and learning; foster active local citizenship, and are pleasant places in which to live, work and visit
Environmental Leadership	Environmental Leadership entails the protection and management of natural systems, habitat and biodiversity, and the innovative and efficient use and management of precious resources such as materials, water and energy
Urban Design Excellence	Urban Design Excellence is best achieved when design thinking concentrates on creating a sense of place within an urban landscape
Housing Affordability	Access to affordable and appropriate housing is a critical element in building sustainable and diverse communities
Commercial Success	Commercial success occurs when the hurdle rate of return on all developments is met or exceeded and environmental, social and economic benefits are maximised

(SCR 2011)

Both tools present assessment criteria grouped into five sections, corresponding with the five objective areas outlined above, aligning the performance measures with the tools' stated objectives. While this connectivity aids internal consistency, it is compromised by the lack of clarity in the overall objectives.

Worth

The Charter and MPCT explicitly adopt the language of sustainability through their statements of purpose and objectives, and both cite the Brundtland report's oft-quoted

definition of sustainable development (VicUrban 2006). However, the way in which the principles of inter-generational and intra-generational equity – central to the Brundtland definition – are manifest in the functionality of the tool is not apparent. Instead, sustainability in both the tools is conceptualised via the five objectives discussed above.

In the absence of any clarification on their interpretation of sustainability, judging how the assessment tools respond to sustainability fundamentals requires careful examination of the individual criteria and their associated scoring and weighting to try and identify connections with sustainability principles and the significance allocated to these (results of this analysis are presented in Table 9). Evidence of response to the key principles of inter-generational and intra-generational equity are often difficult to discern, but such connections are apparent in some individual criteria. Ecological measures, and therefore issues of inter-generational equity, are primarily found in the Environmental Leadership section, although some criteria under the Urban Design Excellence section also impact on ecological sustainability. Both the Charter and MPCT have a strong focus on issues linked to intra-generational equity, with one of the five sections devoted to housing affordability and further criteria in other sections relating to accessibility, localised service provision, and social inclusion. The Housing Affordability section places considerable emphasis on the provision of affordable housing for purchase and for rent. These criteria, in combination with criteria focused on improved accessibility and local service provision, demonstrate a meaningful attempt to engage with the principle of intra-generational equity in the context of urban fringe development.

The issues covered by the Charter and MPCT are determined by the five objective areas, and the particular criteria identified within each of those areas. Table 9 provides an analysis of MPCT's coverage of issues against the list of objectives for operationalising sustainability in urban environments developed in Chapter 3 (see Table 2). The examination of issue coverage includes a calculation of the proportion of the tool devoted to each issue. As MPCT uses a points scoring system, the calculation of priority is based on the number of points available in each issue area as a proportion of the overall points available.

Table 9 – MPCT issue coverage.

Issue	Objective	Criteria	Proportion
Energy consumption and GHG emissions	Direct – Reduce energy (electricity and gas) consumption and/or replace with renewable energy (solar/wind/accredited green power); or eliminate/offset GHG emissions.	EL-1 (6); EL-2 (5); EL-3 (4); EL-4 (2); EL-5 (4); EL-6 (2); UD-12 (6); UD-13 (3); EL-7 (3); EL-19 (2).	**7%**
	Indirect – Increase mode share of public transport to reduce use of fossil fuel intensive transport.	EL-12 (20); CW-11 (4); HA-7 (5); HA-8 (5).	**7%**
	Indirect – Increase viability of walking and cycling to reduce use of fossil fuel intensive transport.	CW-10 (4); CW-14 (4); UD-5-7-16-19-22-28-29-30-34-36-37-38 (28).	**7%**
	Indirect – Reduce distance required to travel by providing or locating near services and employment.	CW-1 (5); CW-3 (5); CW-5 (5); CW-6 (4); CW-7 (5); CW-8 (4); CW-15 (4); CW-16 (4); CW-21 (5); CW-22 (5).	**9%**
Water cycle impacts	Reduce water consumption.	EL-8 (12) ; EL-9 (3).	**3%**
	Improve stormwater management – improve water quality, reduce quantity.	EL-10 (7); EL-11 (3).	**2%**
	Protect and rehabilitate natural waterways.	-	**0%**
Materials and solid waste	Increase use of ecologically preferable materials.	EL-13 (10).	**2%**
	Reduce solid waste impacts.	EL-14 (3); EL-15 (2).	**1%**
Biodiversity and ecology	Protect local bioproductive land, biodiversity and ecology.	EL-16 (2); EL-17 (4); EL-18 (4); CW-2 (5); UD-1-2 (3).	**4%**
Increase quality of life	Community development.	CW-18 (4); CW-20 (4).	**2%**
	Provision of safe urban environments.	HA-2 (10); UD-39 (1).	**2%**
Increase equality	Provision of affordable housing.	HA-1 (10); HA-3 (20); HA-4 (15); HA-5 (25); HA-6 (10); UD-17 (4); UD-18 (4).	**18%**
	Community consultation.	CW-4,17,19 (14).	**3%**
Other areas of significant focus (>2% of tools focus)	Commercial success.	CS-1-10 (100).	**20%**
	Urban design.	CW-12 (4); CW-13 (4) UD-3-4,6,8-11,14-15,20-21,23-27,31-33,40-45 (51).	**12%**

Example Calculation: Determining the issue focus on provision of affordable housing:

- There are 7 criteria in the tool that cover housing affordability (HA-1; HA-3; HA-4; HA-5; HA-6; UD-17: and UD-18), which in combination represents a total of 88 potential credit points.
- The priority is calculated based on the potential number of points available as a proportion of the 500 points available for specific measures (note: this excludes the 50 points available for "industry innovation" as these are additional points that have no specific issues attached to them).
- Therefore the overall priority apportioned to housing affordability is 88/500 = **17.6%.**

The MPCT has a significant number of criteria focused on reducing energy consumption (7% of the tool's overall focus), with the majority of the criteria containing measurable targets. The measures cover the use of energy efficient appliances (heating and cooling; lighting; and hot water systems); the incorporation of passive design principles; and the achievement of energy efficiency star ratings. The EL-1 criterion focuses on passive design, requiring that "building envelopes incorporate climatically responsive passive design principles". This is one of a number of criteria in MPCT that would be difficult to measure in practice due to the lack of targets or design guidelines. As such, there is a lack of clarity in this criterion, making it difficult for assessment to consistently achieve the same result. The EL-2 criterion requires that houses achieve a 6-star or greater rating with FirstRate or NatHERS. At the time of the tool's release, this constituted performance above the mandatory 5-star standard introduced into the Building Code of Australia in 2006 (ABCB 2010). However, with the code updated to require 6-star performance in 2010, this criterion is now equivalent to industry minimum standards. The Urban Design Excellence section also contains measures relating to passive solar design, with UD-12 specifying that the "majority of individual dwelling lots have an east-west orientation" and UD-13 encouraging zero lot lining and other measures to maximise solar access. These would logically seem to be detailed subsets of criterion EL-1 above, rather than separate criteria. The separation of these criteria into different locations under different objectives contributes to the difficulty of discerning the prioritisation of issues in the tool.

The MPCT includes a criterion that encourages the offsetting of carbon emissions, which are a significant component of the environmental impact of any development. EL-7 requires that "the carbon footprint of the development's infrastructure is offset". The criterion lacks a detailed explanation or justification of what the term 'infrastructure' actually includes. Critically, it is not clear whether actual housing construction and materials are included or excluded, and why. Whichever way it is interpreted, carbon neutrality of infrastructure would be a significant achievement for any developer, and seemingly worth more than the 3 points allocated for successful completion of this criterion out of the 110 on offer under the Environmental Leadership objective. This example raises questions of how (if at all) the points scoring system is correlated with quantifiable environmental benefit.

The MPCT has a significant number of measures focused on public transport (7% of the tool's overall focus). The most significant in terms of points available (EL-12, 20 points) requires that a "Sustainable Transport – Travel Strategy for the development is integrated with the urban design and Community Plan". With no detail on what a sustainable travel plan should address, or the targets that should be achieved, the outcomes required to satisfy the criteria are unclear. At 20 points, this is a large component of the environmental leadership performance table, with no clear documentation of what is required. Past versions of the Charter included specific measurable objectives for sustainable transport criteria: one on the provision of bike facilities; and another on the "access to alternative transport", which required that "80% of dwellings are located within two of the following: 800m of a railway station; 400m of a tram stop; 400m of a bus stop; 400m of a ferry terminal or other". This well-recognised proximity standard for sustainable urban transport (Cervero et al. 2002) has been omitted from the MPCT version of the tool, resulting in a far less robust measure, despite the significant impact of high levels of car dependence in urban fringe developments.

Along with the criteria in Environmental Leadership, criteria addressing public transport are also located under the Community Well-being and Housing Affordability objectives.

CW-11 seeks "Commitments secured for early delivery of public transport". HA-7 makes the requirement to "locate affordable housing close to, or with, easy access to public transport, services and employment". As with the transport proximity criterion highlighted above, the MPCT version has lost the specific target provided in the VicUrban Charter, which requires that the location of affordable housing "provides access to public transport within 800m, and ease of connections demonstrated to local and regional services" (VicUrban 2006:27). The MPCT version omits any measurable target as well as the previous stipulation that transport not only needs to be provided, it also needs to take residents where they want to go. HA-8 states: "Promote public transport use through the preparation and communication of public transport travel plans". HA-8 suffers from two fundamental problems. Firstly, it lacks any measurable target for 'promoting public transport' and secondly, simply 'promoting' public transport does not address the level of service or issues of equitable access, nor does it necessarily translate to increased use.

The MPCT also has a significant number of measures focused on increasing the viability of walking and cycling (7% of the tool's overall focus). CW-10 deals with connecting to local employment via public transport, bike and pedestrian routes, while CW-14 deals with the delivery of such bike and pedestrian routes. The Urban Design Excellence section also has a collection of criteria that relate to the facilitation of walking and cycling via layout and infrastructure provision which, when aggregated, add up to a significant proportion of the points available in Urban Design Excellence (22). These measures take the form of a design guide, rather than clearly measurable and justifiable criteria. For example, UD-28 "The urban design reflects a place that is easy to move through for pedestrians, cyclists and other vehicles, without the need for backtracking"; or UD-38 "The urban design provides a range of solutions to ensure that adequate differentiation is provided between pedestrian, cycling and other transport modes". There is also a significant number of criteria addressing the provision of local services and employment, or locating development near well-serviced areas (9% of the tool's overall focus).

The MPCT has two criteria focused on reducing water consumption (3% of the tool's overall focus), with the majority of points (12 of 15) available via EL-8, which pertains to water use per person. This criterion has a stated residential water consumption target of 160L/person/day or less. The significance of meeting this target, however, is limited. The Victorian State Government has, in fact, had a lower consumption target of 155L/person/day in place across metropolitan Melbourne since November 2008, with metropolitan average consumption at 154L/person/day in 2009 and 144L/person/day in 2010 (State of Victoria 2010b; 2011).

The MPCT also has a minor focus on improved stormwater management (2%). These criteria present clear targets for the reduction of pollution loads in stormwater, and the retardation of peak stormwater flows. The VicUrban Charter originally also included water criteria that focused on preservation and rehabilitation of waterways and drainage paths. These have been removed in the MPCT version, narrowing the focus to water conservation (residential and commercial) and stormwater treatment and retention capacity. As well as reducing the scope of water impacts covered by the tool, these omissions also weaken MPCT's ability to effect protection of local ecology, discussed further below.

The MPCT has a minor focus on the use of ecologically preferable materials (2% of the tool's overall focus). EL-13 (10) calls for "independently verified environmental preferred material", but provides no target objective, or detail on how the measure would be achieved or scored. The tool has limited focus on reducing solid waste impacts (1% of the tool's overall focus), with the two criteria limited to coverage of construction waste management, and no criteria addressing the infrastructure and built form response to managing solid waste over time.

The MPCT has several criteria focused on protecting local biodiversity and ecology, scattered between the Environmental Leadership, Urban Design Excellence and Community Well-Being sections, resulting in 4% of points focused on this area. Criteria in the Environmental leadership section focus on maximising the use of native vegetation in plantings, and achieving "net gain in native vegetation". UD-1 and 2 are

criteria relating to the protection of natural heritage and incorporation of environmental landscape features in urban design. Only CW-2, under the Community Well-being objective, makes mention of assessment of ecological significance, with the criterion requiring a "study completed of cultural, social, natural and built heritage and findings incorporated in all design documents, incorporating if applicable a heritage strategy". Overall, these measures do little to encourage leadership in biodiversity and ecology protection in the urban development sector.

With one of the five tool objectives centred on Housing Affordability, the MPCT has a predictably strong focus in this area (18% of the tool's overall focus). It contains measures that focus on the provision of affordable housing for both purchase and rent. The criteria are precise, with clear targets generally specified. HA-4, for example, requires a "proportion of land lots that are costed in the lowest quartile of the local market. (Target = 40%)", while HA-5 requires the "proportion of total house and land packages delivered to the market at an affordable purchase price for moderate income households. (Target is 15% of packages priced below $270,000 – 2008)". HA-3 addresses affordable rental housing, requiring a "minimum 10% of project total offered for affordable rental housing managed by an accredited not-for-profit housing agency". This represents a significant and concerted effort to increase the number of affordable rental properties in new developments. HA-6 seeks to encourage developments that "offer house and land designs that deliver demonstrated whole-of-life savings in household expenditure and energy savings". In an industry that typically considers only the up-front purchase price when addressing affordability, this is a commendable attempt to consider the ongoing costs of housing to the occupant. However, with no specification of targets, the significance of outcomes resulting from successful compliance with this criteria are not evident. The emphasis placed on housing affordability by the MPCT is further highlighted by the existence of several housing affordability criteria in the Urban Design Excellence section, with an additional 8 points available in measures that essentially repeat the requirements of diversity in lot sizes and building types covered under the Housing Affordability section.

The MPCT encompasses a very broad range of issues within its five objective areas. An issue not covered above that attracts significant attention is that of Commercial Success (20% of the tool's overall focus), which is one of the five central objectives of MPCT. The criteria in this section cover the meeting of financial arrangements and targets (internal rate of return and gross margin); demonstrating the benefits of significant initiatives, either in terms of cost recovery or other means; and risk management procedures. MPCT also has a substantial number of measures focused on urban design (12% of the tool's overall focus). These criteria relate to issues such as open space design; responding appropriately to local context; providing "distinctive visual character"; creating "vibrant" places; and ensuring visual connectivity. Many of these criteria are vaguely worded, lacking deliverable outcomes. For example, UD-4 seeks urban design that "demonstrates a clear positive response to the opportunities and constraints provided by the site, its context and market research". Other issues with limited coverage in MPCT include community engagement and consultation (4% of the tool's overall focus) and safety / disability access (2% of the tool's overall focus).

Rigour

The assessment approach of the Charter and the MPCT is criteria-based, using a domains conception of sustainability, with the standard triple bottom line broadened and modified to include five sections, corresponding to each of the tools' five objectives. Each section is made up of lists of performance criteria, with criteria attracting a point value. The number of criteria varies in each section (see Table 10), but the sum of the points available in each section is the same, totalling 100 points plus an additional 10 discretionary points awarded for an "industry advancement initiative" (SCR 2011). The tools essentially operate as checklists of actions to be considered in the design phase of development, with the final score providing an assessment of the intended development. Measurement in later phases of development allows assessment of progress against original intent. Assessment scores can also be used to compare developments with other similar projects.

Table 10 – MPCT distribution of criteria and points available.

Section	Number of criteria	Points available against criteria	Points available for industry advancement initiative
Commercial Success	10	100	10
Community Well-being	23	100	10
Environmental Leadership	20	100	10
Urban Design Excellence	45	100	10
Housing Affordability	8	100	10
Total	**106**	**500**	**50**

(SCR 2011)

Prioritisation of issues occurs in a number of ways. The first is through the specification of domain areas. By modifying the typical triple bottom line approach, which seeks a balance between economic, environmental and social issues, to include five domains (each carrying the same points value, and thereby equally weighted), the tools' developers have effectively prioritised certain issues. Economic issues are captured under the Commercial Success section, while environmental issues and social issues are captured under the Environmental Leadership section and the Community Well-being section respectively. Housing affordability – which one would expect to be captured under the Community Well-being section, along with other social issues – makes up one of the remaining five sections, along with Urban Design Excellence. By isolating and elevating housing affordability and urban design to the 'bottom line', the tool's developers have assigned these particular issues a greater degree of priority. A second stage of prioritisation occurs through the inclusion and exclusion of criteria under each section, which is discussed in the previous analysis of issue coverage. The third, and most overt, form of prioritisation in the MPCT occurs through the allocation of a points value to each criterion. There is no justification or rationale provided for the allocation of points, however, raising concerns regarding the relative significance of various criteria and their contribution to the overall score. As highlighted in the

examples discussed above, it is not always evident that criteria which attract a higher number of points necessarily have a more significant impact than those assigned a lower point value.

The VicUrban Charter outlines a detailed process for applying the tool during the stages of project selection, project vision, project design, project delivery and final review, including points at which review and approval by the VicUrban board is required (VicUrban 2006:14). This clearly articulated and systematic process ensures rigour in application and allows for consistent repeatability of assessment. However, with the move to the MPCT, this application process has been removed from tool documentation, leaving it open to users to determine how to utilise the tool within their organisation. The fact that MPCT is presented as a self-assessment tool (SCR 2009) significantly weakens its accountability, since there is no independent party involved in the assessment process.

The Charter contains a brief explanation of the development of the tool, stating that "the scoring system for each core objective has been determined as a result of an expert internal and external review making a judgement of value relative to other priorities in that objective" (VicUrban 2006:6). This implies that the criteria that make up each section – the same criteria used in the MPCT, with minor changes – have been chosen because evidence and/or expert opinion suggests that they lead to improved sustainability performance. However, as discussed previously, the derivation of these criteria is not clear, other than that they relate to VicUrban's five core business objectives, and there is no justification provided for their selection or any explanation of why the targets (if offered) are appropriate. The MPCT currently presents no mechanism for validating the assessment findings and there is also no documented process of continual improvement. The Charter does state that it "will be continuously improved by refining the performance measures through consultation and advice from internal and external stakeholders" (VicUrban 2006:6) and the evolution from the Charter to MPCT, and ultimately to GBCA's Green Star Communities, is evidence of continued development of the tools. However, the rationale for updating criteria and

metrics is not evident and, as demonstrated above, has often resulted in a relaxing of criteria requirements or specificity.

Practicality

The Charter and MPCT are specifically targeted at the MPE scale of development and integrate well with the development delivery process, making them practical to use as decision-making aids. In project goal setting and design, the tools act as checklists of potential initiatives to incorporate into a given project. In subsequent development phases the MPCT tracks how the identified performance measures are included in a given development. As a self assessment tool based on flexible checklists of criteria, the tool requires very few resources to implement. However, without an accreditation component, there is no capacity to make claims of performance to external stakeholders, such as potential house and land purchasers. As such, the tool acts primarily as a decision support tool in the planning and design of new development, providing lists of understandable options, across a broad range of key issues, to consider throughout the development delivery process.

Summary

VicUrban employs the language of sustainability to frame its organisational goals, which are also used as the core objectives of the Sustainability Charter and the MPCT. Both tools adopt a triple bottom line approach to sustainability assessment, though it is not obvious how principles of sustainability have been interpreted, or how these have been translated into action, with the tools' five objectives lacking detail and clarity. Only one of the five sections (Commercial Success) clearly articulates requirements to successfully meet its objective.

The tools are criteria-based, with criteria selection the result of input from multiple contributors, including external experts. No detail is provided, however, on the process of criteria development, nor is any justification given for the final selection and weighting of criteria. While the tools cover a broad range of issues, there are no mandatory criteria or hurdle requirements, meaning that none of these issues are compulsory to address. Many of the criteria lack the detail needed to determine what

actions are required to achieve full or partial points. When the Charter was updated to become MPCT, several measurable targets were removed from criteria, further exacerbating this ambiguity and leaving assessment open to a greater degree of subjectivity. The degree to which the tools' standards extend current practice varies significantly – in some areas meeting standards requires significant action, while in others the requirements only meet or marginally extend current practice.

6.3 LEED-ND

LEED-ND is an assessment and accreditation tool developed in partnership by the USGBC, the Congress for the New Urbanism (CNU), and the Natural Resources Defence Council (NRDC). LEED-ND is designed for accreditation of precinct scale developments and aims to produce a "national set of standards for neighborhood location and design based on the combined principles of smart growth, new urbanism, and green building" (USGBC 2007:1). Its focus on the 'neighborhood' scale of development is described as an "emphasis on the design and construction elements that bring buildings together into a neighborhood, and relate the neighborhood to its larger region and landscape" (USGBC 2007:1). The version of the LEED-ND reviewed here is the first full version, released in 2009 (USGBC 2009). This version follows the Preliminary Draft (USGBC 2005), released in 2005; the Pilot Version (USGBC 2007), released in 2007; and a public comment draft released in 2008 (USGBC 2008a). The original 2009 full release is still active, though updates were made in late 2010.

Openness

LEED-ND is available for download in full form on the USGBC website (USGBC 2011a). The tool documents the criteria used for assessment, specifying the intent of each criterion, the requirements to satisfy compliance with each criterion, and clarification of terms to reduce ambiguity, making for a transparent criteria framework. The LEED-ND website makes available extensive documentation on the development of the tool, including methodology, persons involved in the tool development and their affiliation, the consultation process, the full pilot release of the tool and associated feedback, and the process for ongoing review (USGBC 2011a).

Merit

The stated goal of LEED-ND is "to establish a national leadership standard for assessing and rewarding environmentally superior green neighborhood development practices" (USGBC 2009:xii). It aims to achieve this by "creat[ing] a label, as well as guidelines for both decision-making and development, to provide an incentive for better location, design, and construction of new residential, commercial, and mixed-use developments." (USGBC 2009:xii).

Specific objectives for LEED-ND are not overtly articulated in the published rating tool. However, the introductory section of the tool makes objectives apparent by highlighting negative aspects of existing urban development, and a desired alternative. It refers to the current undesirable urban form, characterised by "automobile-oriented neighborhoods" and consisting of "segregated land uses accessed by highspeed roadways that necessitate the use of cars" (USGBC 2009:xi), pointing out the following negative consequences of such development:

- significant GHG emissions;
- air pollution and related respiratory diseases;
- hostility to pedestrians;
- unsupportive of traditional mixed-use neighbourhood centres;
- fragmentation of habitat, endangering sensitive land and water bodies;
- destruction of productive farmland; and
- presenting an increased burden on municipal infrastructure.

It goes on to identify an alternative of "thoughtful neighborhood planning and development", producing "green development" and containing "green buildings" (USGBC 2009:xi). Such 'green developments' are described as places that:

- reduce the extent of car usage by locating residences and jobs close to one another;
- facilitate mixed-use development and walkable streets to encourage walking, cycling and public transport;
- contain environmentally responsible buildings and infrastructure to decrease natural resource consumption, energy consumption and GHG emissions; and reduce negative impacts on water resources and air quality;

- enable a wide variety of residents to be part of the community by including housing of varying types and price ranges;
- respect historical resources and the existing community fabric;
- preserve open space and encourage access to parks;
- recognise that the character of a neighbourhood, including its streets, homes, workplaces, shops, and public spaces, significantly affects the quality of life; and
- recognise that green buildings, community gardens, and streets and public spaces which encourage physical activity are beneficial for public health.

(USGBC 2009).

This list of priorities is reflected in the structure of the rating framework which groups criteria into three main categories: Smart Location and Linkage, Neighborhood Pattern and Design, and Green Infrastructure and Buildings. While the intent of LEED-ND can be deduced from the introductory content outlined above and the structure of the rating framework, the tool provides no clear statement of objectives to justify the list of criteria that follow. As such, it is difficult to discern whether the suite of criteria provided can, in fact, deliver on the tool's stated purpose, making for weak internal consistency.

Worth

LEED-ND is presented as a tool which aims to aid implementation of sustainability, providing independent certification of urban developments that "meet accepted high levels of environmentally responsible, sustainable development" (USGBC 2011a:para.1). The principles underpinning LEED-ND, as declared by the USGBC, are drawn from those of smart growth, new urbanism and green building (USGBC 2011a). The Smart Growth Network is a US-based organisation that promotes urban developments that "boost the economy, protect the environment and public health, and enhance community vitality", a purpose that aligns with the triple bottom line conception of sustainability (SGN 2006:i). The 10 principles of smart growth encourage compact, diverse, mixed-use, walkable neighbourhoods with multiple transport options; the preservation of open space farmland and areas of ecological significance; and open, fair and collaborative decision making processes (SGN

2006:iii). The New Urbanism Charter (as discussed in detail in Chapter 2) similarly presents 27 principles "to guide public policy, development practice, urban planning, and design" (CNU 2001:2). Those that relate to the neighbourhood or estate scale focus on the creation of compact, diverse, mixed-use, walkable neighbourhoods, in which most daily needs can be met locally, and the provision of local parks and open space (CNU 2001).

While the LEED-ND tool is not explicitly based on sustainability principles, there is nonetheless a degree of commonality between many elements of smart growth, new urbanism and sustainable urbanism, and direct reference to sustainability occurs in several locations throughout the tool and associated documentation. Taking its lead from new urbanism, LEED-ND advocates an alternative to urban sprawl in "new traditional" urban developments "that are compact, complete, and connected, and ultimately more sustainable and diverse" (USGBC 2009:xvi). It is also presented as a benchmarking tool with which local government can evaluate how "'friendly' to sustainable developments" their local planning policies are (USGBC 2009:xv). Further, the LEED suite of tools, including LEED-ND, are identified as critical components in achieving the "USGBC's mission of a sustainable built environment for all within a generation" (USGBC 2009:i). LEED-ND can therefore be regarded as a tool which seeks to facilitate sustainability in urban development, with a specific, functional focus on new urbanism and smart growth as interpretations of sustainability in the context of precinct scale urban development.

Table 11 below presents the coverage of issues of concern in LEED-ND, against the list of objectives for operationalising sustainability in urban environments developed in Chapter 3 (see Table 2). The examination of issue coverage includes a calculation of the proportion of the tool devoted to each issue. The allocation of proportion of issue focus is calculated as follows:

- LEED-ND is made up of prerequisite criteria, and optional credits. The prerequisites, being compulsory, have no associated points. The optional credits, however, do attract points. Therefore, the issue focus of the prerequisite measures and credit measures are calculated separately.

- The focus of prerequisite criteria is calculated as a proportion of the 12 prerequisites in the tool. Therefore each of the prerequisite measures is apportioned 1/12 of the tool's prerequisite priority.
- The focus of the credit measures is calculated as a proportion of the 100 points available in the tool. Therefore a credit measure that has a potential five points available is apportioned 5/100 of the tool's credit priority.
- An indication of overall priority is provided by calculating the average of the prerequisites and credit proportions for each issue area.

Example Calculation: Determining the issue focus on provision of affordable housing:

- There are no prerequisite measures that cover housing affordability, therefore no prerequisite priority is apportioned to this issue.
- There is one credit measure that covers housing affordability (NPD-C4) which has seven points available. Therefore 7/100 (7%) of the credit priority is apportioned to this issue.
- The overall priority apportioned to housing affordability is the average of the prerequisite and credit priorities:
  = (0% + 7%)/2
  = **3.5%**

Table 11 – LEED-ND issue coverage.

Issue	Objective	Prerequisites *(Proportion)*	Credits *(Proportion)*	Average proportion
Energy consumption and GHG emissions	Direct – Reduce energy (electricity and gas) consumption and/or replace with renewable energy (solar/wind/accredited green power); or eliminate/offset GHG emissions.	GIB-P1 GIB-P2 *(16.7%)*	GIB-C1 (5); GIB-C2 (2); GIB-C10 (1); GIB-C11 (3); GIB-C12 (2); GIB-C13 (1). *(14%)*	**15%**
	Indirect – Increase mode share of public transport to reduce use of fossil fuel intensive transport.	*(0%)*	SLL-C3 (7); NPD-C7 (1); NPD-C8 (2). *(10%)*	**5%**
	Indirect – Increase viability of walking and cycling to reduce use of fossil fuel intensive transport.	NPD-P1 NPD-P2 NPD-P3 *(25%)*	NPD-C1 (12); NPD-C2 (6); NPD-C3 (4); NPD-C5 (1); NPD-C6 (2); NPD-C14 (2); SLL-C4 (1). *(28%)*	**27%**
	Indirect – Reduce distance required to travel by providing or locating near services and employment.	SLL-P1 *(8.3%)*	SLL-C5 (3); NPD-C9 (1); NPD-C10 (1); NPD-C15 (1). *(6%)*	**7%**
Water cycle impacts	Reduce water consumption.	GIB-P3 *(8.3%)*	GIB-C3 (1); GIB-C4 (1); GIB-C14 (2). *(4%)*	**6%**
	Improve stormwater management – improve water quality, reduce quantity.	GIB-P4 *(8.3%)*	GIB-C8 (4). *(4%)*	**6%**
	Protect and rehabilitate natural waterways.	SLL-P3 SLL-P5 *(16.7%)*	*(0%)*	**8%**
Materials and solid waste	Increase use of ecologically preferable materials.	*(0%)*	GIB-C5 (1); GIB-C15 (1). *(2%)*	**1%**
	Reduce solid waste impacts.	*(0%)*	GIB-C16 (1). *(1%)*	**1%**
Biodiversity and ecology	Protect local bioproductive land, biodiversity and ecology.	SLL-P2 *(8.3%)*	SLL-C6 (1); SLL-C7 (1); SLL-C8 (1); SLL-C9 (1); GIB-C7 (1). *(5%)*	**7%**
Increase quality of life	Community development.	-	-	**0%**
	Provision of safe urban environments.	-	NPD-C11 (1) *(1%)*	**<1%**
Increase equality	Provision of affordable housing.	-	NPD-C4 (7) *(7%)*	**4%**
	Community consultation.	-	NPD-C12 (2) *(2%)*	**1%**
Other areas of significant focus (>2% of tools focus)	Protection of local agriculture.	SL-P4 *(8.3%)*	NPD-C13 (1) *(1%)*	**5%**
	Location for enhanced urban consolidation.	-	SLL C1 (10); SLL C2 (2) *(12%)*	**6%**

LEED-ND contains a considerable number of criteria that target reduced energy consumption, constituting 15% of the tool's overall focus. Significantly, two of these are prerequisites. GIB-P2 requires that 90% of a development's building floor area meets energy efficiency targets in excess of legislated standards, with homes required to meet EPA Energy Star rating – making them "20-30% more efficient than standard homes" (US EPA 2009) – and other buildings required to perform at least 10% better than building standards. The remaining optional energy criteria build on this prerequisite, awarding points for improvement above the required minimum, and additional points for solar orientation and renewable and efficient energy infrastructure. Each optional criterion has a clear measurable target presented, and a sliding scale outlining the requirements to achieve points where multiple points are available. For example, GIB-C11: On-Site Renewable Energy Sources, awards one point where 5% annual electrical and thermal energy is from an on-site non-polluting renewable energy generation source; two points for 12.5%; and the full quota of three points for 20% renewable sources.

GIB-P1, which is also mandatory, requires that at least one building be certified by a LEED building scale tool, or "through a green building rating system requiring review by independent, impartial, third-party certifying bodies as defined by the International Organization for Standardisation" (USGBC 2009:77). This prerequisite appears to be aimed at encouraging developers to engage with building accreditation tools, rather than mandating action across the development or achieving a significant reduction in energy use, since certification of a single building would have negligible effect on the overall impact of a development. The specification of the use of other LEED tools also points to a cross-promotional motivation, although an allowance for other accrediting systems is provided.

Reflecting its roots in new urbanism and smart growth, LEED-ND has a large proportion of criteria focused on changing the nature of urban form, with the primary objective of reducing reliance on fossil fuel intensive transport. There are three optional criteria that specifically target access to and provision of public transport, constituting 5% of the tool's overall focus. There are also several criteria focused on reducing the

distance required to travel by providing or locating homes near services and employment (7% of the tool's overall focus). These include a prerequisite measure (SLL-P1: Smart Location), requiring that all developments be located on a strategically appropriate site "within and near existing communities and public transit infrastructure" (USGBC 2009:1). There are four options to meet the criterion: build on an infill site; locate the development adjacent to an existing site (with connectivity provided); locate in a transit corridor; or locate on sites with multiple nearby community assets. Optional criteria build on this mandatory requirement, awarding points for access to employment opportunities, civic and public space, recreational facilities and schools.

Amongst the measures aimed at reducing the use of fossil fuel intensive transport, the creation of urban form that facilitates walking and cycling constitutes the greatest proportion of the tool's focus (27% of the overall focus). Significantly, this includes three prerequisite measures. NPD-P1: Walkable Streets sets requirements for sidewalks, active street frontages and human scale streetscapes; NPD-P1: Compact Development sets dwelling density targets; and NPD-P3: Connected and Open Community sets requirements for minimum intersection points and connecting streets. Optional measures award points for performance above the prerequisite requirements, as well as points for the provision of mixed-use neighbourhood centres, reduced parking, bicycle networks and storage facilities, and tree-lined and shaded streets.

LEED-ND also has a considerable focus on urban water cycle issues, with 6% of the tool's overall focus on reducing water consumption, 6% on minimising stormwater impact, and 8% on the protection and rehabilitation of natural waterways. Each of these three areas contains prerequisite criteria. GIB-P3 sets minimum requirements for reducing water consumption, with optional criteria then providing points for additional improvements on building water efficiency, landscape water efficiency, and superior waste water management. With regards to improved stormwater management, there is a mandatory requirement (GIB-P4: Construction Activity Pollution Prevention) to engage with "best management practices … to control erosion and sedimentation in runoff from the entire project site during construction" (USGBC 2009:82), while additional credit points are allocated for retention of stormwater flows on site "through infiltration,

evapotranspiration, and/or reuse" (USGBC 2009:93). Protection of natural waterways is covered by two prerequisite criteria: SLL-P3 sets requirements for conserving wetlands and water bodies, while SLL-P5 sets requirements for avoiding development of floodplains.

LEED-ND has negligible focus on ecologically preferable materials or solid waste management. Optional credit points are available where existing buildings are reused in development; where extensive recycled content is used in infrastructure provision, or where additional waste management infrastructure (such as recycling, composting, or hazardous waste disposal) is provided.

The tool has a considerable focus on protecting local biodiversity and ecology (7% of the tool's overall focus). There is one prerequisite covering this issue, requiring an approved habitat conservation plan under the United States Federal Endangered Species Act (or equivalent) to protect ecologically sensitive species and communities. Optional credit points are allocated for the protection of existing natural site conditions, and for the restoration and long term conservation management of habitat or wetlands and water bodies.

There is only one optional criterion dedicated to housing affordability issues, but with up to seven points available, it constitutes 4% of the tool's overall focus. This criterion (NPD-C4 Mixed-Income Diverse Communities) awards points for the provision of a diversity of housing types, and for the provision of affordable housing. Detailed measurable targets are provided on a sliding scale for allocating points.

Unlike EnviroDevelopment and MPCT, LEED-ND pays significant attention to the location of development in the context of broader strategic urban planning issues. As outlined above, there are extensive measures addressing the form and function of a development with respect to the accessibility of services and transport infrastructure, and facilitation of walking and cycling. The tool also has a number of measures which consider the location of the development within the existing urban form, with criteria focused on locating development to capitalise on existing urban infrastructure and

reduce pressure on undeveloped land (6% of the tool's overall focus); and on protecting and enhancing local agricultural land (5% of the tool's overall focus). The preferred location criterion (SLL C1) provides up to ten points, rewarding the development of previously used or infill sites; high connectivity with existing urban form; and location in government specified high-priority redevelopment areas. Brownfield redevelopment is rewarded with a further two points (SLL C2). There is also a prerequisite measure for the protection of agricultural land (SLL-P4 Agricultural Land Conservation), and a point available for facilitating local food production (NPD-C13).

Rigour

LEED-ND uses a criteria-based assessment methodology, with criteria grouped into three main categories: Smart Location and Linkage; Neighborhood Pattern and Design; and Green Infrastructure and Buildings. There are also two 'bonus point' categories: Innovation and Design Process; and Regional Priority Credit. The tool is made up of lists of 'prerequisites' and 'credit' performance measures. The prerequisites must be completed in order to achieve LEED certification, while the credit measures are optional and have weighted point values that signify the relative importance of each measure.

The total number of credit points available across the three main categories is 100, with a further 10 bonus points available via the bonus categories. A development can be certified as a result of a third-party assessment process, with the level of certification based on the number of points achieved: basic certification (40+ points); silver (50+ points); gold (60+ points); or platinum (80+ points). The distribution of performance measures and points available is shown in Table 12, revealing significant differences in the number of points available across the categories, with the Neighborhood Pattern and Design category containing a substantially higher number of measures and points available, and the Design Process and Regional Priority categories containing minimal points.

Table 12 – LEED-ND distribution of criteria and points.

Categories	No. of prerequisites	No. of optional criteria	Points available
Smart Location and Linkage	5	9	27
Neighborhood Pattern and Design	3	15	44
Green Infrastructure and Buildings	4	17	29
Design Process	0	2	6
Regional Priority Credit	0	1	4

(USGBC 2009)

Each criterion includes detailed supporting information, including the 'intent', which identifies the main goal(s) of the measure; and the 'requirements' or evidence needed to satisfy the criterion. The requirements typically present several options for compliance. All criteria therefore transparently specify a measurable target, and the accepted means for demonstrating compliance with the target, thus minimising subjectivity in assessment. The criteria frequently call on external sources to detail and justify content, including US government agencies and the International Standards Organization. This makes for strong accountability and repeatability.

Prioritisation of issues in LEED-ND occurs in two ways: through the use of prerequisite criteria; and through the distribution of points. A developer cannot achieve any level of LEED accreditation without complying with all the prerequisite criteria across each of the category areas. As such, the highest level of prioritisation is assigned to the issues covered in the prerequisite criteria. Each of the 44 optional criteria are allocated between 1-12 points, with a total of 110 points on offer. The more points available, the greater priority placed on the issue. The majority of criteria attract only one or two points, while only three criteria have greater than six points available. The tool declares that the allocation of credit points is "based on the relative importance of the neighborhood-related impacts that [each criterion] addresses", with relevance based on attempts to quantify impact utilising "energy modelling, life-cycle assessment, and transportation analysis", as well as consideration of the "market implications of point

allocation" (USGBC 2009:xiii). The justification for weighting is documented in a weightings workbook.

The Green Building Certification Institute was established in 2008 to provide independent third party assessment of developments using the LEED suite of tools (GBCI 2011). The process for certification under LEED-ND is documented in the tool, and supported by a detailed Certification Policy Manual that outlines the project registration process, application submission and review process, and certification costs (GBCI 2009). A three stage certification process allows applicants to receive pre-certification, holding back full certification until projects are completed and applicants can demonstrate full compliance with the assessment criteria. The first stage is optional, offering conditional approval "to help the developer build a case for entitlement among land-use planning authorities, as well as attract financing and occupant commitments" (USGBC 2009:xix). The second stage provides pre-certification, which is available after the project is "fully entitled by public authorities with jurisdiction over the project" (USGBC 2009:xix). This allows developers to market their project as LEED-ND pre-certified. The third stage is full certification once the project is completed, to ensure the project complies fully with the prerequisites, at which point the final level of certification is determined.

The tool was developed through a committee-based process with extensive public and stakeholder consultation. This process has been made transparent, with the names and affiliations of all committee members and committee meeting minutes made publicly available, and several rounds of open consultation conducted. An initial draft tool was publicly released in 2005 (USGBC 2005) to solicit input from stakeholders and interested parties to aid development of the pilot tool. The pilot version of LEED-ND was released in 2007 and was applied to numerous developments (USGBC 2007; 2008b). Following this a revised public comment draft of the tool was released, including a version that explicitly highlighted any additions or omissions from the pilot version (USGBC 2008a). Finally, review and modification was carried out by technical advisory panels for each area, again with meeting minutes available to explain all decisions made. The full version 1 of LEED-ND was released in late 2009 after

receiving consensus approval from a USGBC member ballot and partner organisations (USGBC 2009). The tool states that the "credit weightings process will be re-evaluated over time to incorporate changes in values ascribed to different neighborhood impacts and neighborhood types, based on both market reality and evolving knowledge related to buildings and neighborhood design" (USGBC 2009:xiv). In November 2010 an update to version 1 was released (USGBC 2010).

Practicality

Targeted at the 'neighborhood' scale of development, LEED-ND has a relatively flexible scale and scope of application, stating that "projects may constitute whole neighborhoods, portions of neighborhoods, or multiple neighborhoods" (USGBC 2009:xiv). This makes it applicable to greenfield developments, such as master planned estates and traditional subdivisions, as well as large urban infill and redevelopment projects. The tool also aims to integrate with local planning systems, with the USGBC stating that LEED-ND is "a meaningful tool to help promote sustainable land development if incentivized or used as a guideline when revising local codes and regulations" (USGBC 2011b). To aid this integration, the USGBC have released a guide for local government use of LEED-ND (USGBC 2011c). The tool's staged accreditation process, which offers conditional and pre-certification approval to aid in marketing and planning approval processes, also recognises the importance to developers of being able to associate a development with a certification scheme in the early stages of a project.

LEED-ND documentation comprehensively details the requirements of its criteria, with the onus falling on applicants to demonstrate compliance through the provision of evidence. This demands a relatively high degree of resourcing with substantial effort from the applicant, and often requiring specialist input. The USGBC does, however, offer a wide range of information and training workshops for industry to aid in the implementation of LEED-ND. The sometimes onerous nature of providing evidence of compliance is also ameliorated to some degree by the fact that information requirements for certification have been integrated with those of the development approval process where possible. This further demonstrates efforts by USGBC to ensure practicality of

the tool, by making it work within existing development and planning approval contexts.

Summary

LEED-ND is presented as a tool for facilitating sustainable development, but it does not directly invoke sustainability as the foundation of the framework. Instead, the tool openly declares its roots in new urbanism and smart growth. The scope of the objectives of LEED-ND extend beyond the impact of a given development, and pay significant attention to the role of urban development in achieving a more sustainable broader urban form.

LEED-ND is a criteria-based assessment tool, developed through a well documented and open committee-based process. While the process of tool development is clear, the lack of stated objectives makes the justification for criteria unclear. Along with the tool's coverage of typical environmental impact reduction issues, many criteria address the urban form of development, the development's relationship to existing urban areas, and strategic planning objectives. LEED-ND makes use of prerequisites to impose minimum standards across the issue areas covered. The criteria all have clear targets, and many criteria have a sliding scale of points available, with maximum points requiring significant improvements upon current practice.

LEED-ND is accompanied by detailed documents that specify weighting methodology, certification processes, and integration with local government policy. It also offers training programs that aid implementation of the tool.

6.4 Ecological Footprint Analysis

EFA is a widely used ecological sustainability assessment methodology that is increasingly being applied in an urban planning and development context. Its creators claim that it is "a powerful tool for comparing the ecological demand of design options such as housing densities, transportation systems or infrastructure development" and, as such, can be used to evaluate and potentially influence broader consumption patterns, since:

> urban design has a significant impact on people's consuming behaviour. It influences not only how they shop, but also how they move around, what kind of houses they live in and what kind of urban infrastructure services they require (Wackernagel and Yount 2000:34).

In urban development projects, therefore, EFA can be used to not only comprehend impact, but also to set targets, evaluate progress, evaluate project alternatives, and assist decision-making for both policy and project development (Wackernagel et al. 2005).

Several examples of the use of EFA as an assessment framework for urban developments have been documented, with studies having used the tool to assess the ecological impacts of various urban forms. Holden (2004) carried out an analysis of 537 houses within a variety of urban forms in Norway, concluding from the footprint results that 'decentralized concentration' provides the most sustainable urban form. Muniz and Galindo (2005) used EFA to analyse travel-to-work behaviour in Barcelona, illustrating that urban form has a clear effect on travel behaviour (greater than socio-economic factors such as average family income), and therefore that compact city policies that incorporate public transport and a mix of populations and activities result in lower transport ecological footprints.

EFA is also being used at the individual suburb scale. Haraldsson et al. (2001), for example, attempt to quantify the ecological benefits of 'eco-living' by comparing an eco-village and a conventional suburban development in Sweden, while Moos et al. (2006) conducted a similar study in the United States, using ecological footprint analysis to evaluate three different design proposals for the one development site: an ecovillage; a new-urbanist design; and an high-end estate subdivision. There are also several examples of the application of EFA to MPEs in Australia, including studies of the Aurora development in Melbourne (Centre for Design at RMIT and Global Footprint Network 2006), reviewed at length below; and studies of developments in Mawson Lakes (Fehring 2007) and Lochiel Park (Blaess et al. 2007), both in Adelaide.

EFA differs from the three tools discussed earlier in this chapter in that it is a broad assessment methodology, rather than a tool specifically targeted at urban development. Because of this broad scope, and the diversity of its practical applications, it is pertinent

in the context of this research to examine the specific application of EFA to MPE development, rather than to conduct a critical analysis of the EFA methodology itself. This analysis of EFA as a tool for sustainability assessment of MPEs is undertaken by examining EFA methodology (based on the Global Footprint Network standards and analytical literature) in combination with examples of its application to MPEs, with particular attention paid to the EFA of VicUrban's Aurora development.

The Aurora EFA was undertaken in 2006 by the Centre for Design at RMIT University and the Global Footprint Network, on behalf of VicUrban, EPA Victoria, and the Building Commission (Centre for Design at RMIT and Global Footprint Network 2006). Aurora is VicUrban's flagship greenfield project, with the aim of setting a new benchmark in sustainable urban development (VicUrban 2004). On completion, it will have in excess of 8,000 dwellings, two town centres, five schools and 148 acres of public open space and conservation areas (VicUrban 2007). The development's major environmental features include 6-star energy rated homes with compulsory gas-boosted solar hot water; a third-pipe system bringing recycled water to homes; the option of rainwater-fed hot water systems; comprehensive water sensitive urban design; compulsory use of eco-preferable materials (administered by a building scorecard); design requirements to maximise beneficial dwelling orientation and solar efficiency; and master planning to promote walking and cycling over car use and to promote a degree of self-containment. VicUrban is also lobbying for a rail link from an existing line into the Aurora development, which as yet remains unfunded.

The wide array of environmental initiatives being implemented at Aurora presents a challenge in understanding the significance of the combined effort. A key motivation for the study of Aurora was to quantify the impacts of these initiatives, and to allow comparison with conventional developments. The increasing acceptance and understanding of the Ecological Footprint as a measure of environmental performance also made it appealing to VicUrban as a means for communicating the environmental achievements of Aurora to customers and stakeholders. The use of the Ecological Footprint was further supported by a key stakeholder, the Victorian Environment Protection Authority, which commissioned an EFA of Victoria (Global Footprint

Network and The University of Sydney 2005), thereby providing a starting point for the Aurora EFA calculations.

Openness

EFA is a deliberately open methodology for the quantitative assessment of the ecological impact of human development. The non-profit Global Footprint Network is the custodian of the methodology, advancing the methodological and data basis of EFA; producing standards for its use; and applying EFA in a variety of settings, including global accounts, national accounts, and city and regional footprints. Standards are updated regularly by the standards committee, with standards and committee membership published on the Global Footprint Network website. However, the use of EFA is not limited to the Global Footprint Network, and reports and publications based on EFA are too numerous to count. There exists a large active professional and academic community refining and applying EFA methodology for specific uses. This discourse is documented in journal articles and government and private sector reports (in particular see debates in the Journal of the International Society for Ecological Economics).

Merit

The purpose of EFA is clearly articulated in the documentation surrounding its development. Its aim is to quantify the capacity of the Earth to provide for human existence, and the level to which human populations are appropriating this capacity. It is an ambitious aim, requiring complex calculation methods and data collection, and it is this complexity, rather than any uncertainty of purpose, that has sparked widespread and vigorous debate over the achievability of such an approach (Ayres 2000).

EFA has a clearly expressed target goal – that is, a population living a lifestyle that is within the regenerative limits of the Earth's biological capacity. It is able to provide rigorous evaluation of achievements against this goal, through the measurement of physical impacts. It also provides a revealing appraisal of the significance of these achievements, and of the significance of the challenges ahead. The aim of applying EFA to urban development is to calculate the ecological footprint of a specific

development project, thereby obtaining a measure of that development's impact within the context of ecological limits.

Merit requires that an assessment approach has the potential to deliver on its objectives. The metrics of EFA are directly aligned with its objectives, focusing on calculating the bioproductive capacity of nature, and the ecological demand of human activity. This gives the methodology strong internal consistency. However, the complexity of the task that EFA sets for itself has caused many to question the ability of the methodology to meaningfully deliver on its objectives. This is particularly the case at the project evaluation scale, where EFA has been used both for assessing existing developments, based on actual measured consumption data, and as a design or scenario testing tool, based on modelling data and assumptions about how a design proposal will affect future consumption patterns. In these contexts, assessment tools need to have the requisite sensitivity to aid evaluation of specific and detailed changes in project briefs, in order to usefully inform decision-making processes.

Findings from the Aurora case study highlight the EFA methodology's lack of sensitivity to certain key issues. The aim of the study was to compare the proposed development with both conventional greenfield developments in Victoria and global ecological limits. The EFA also aimed to compare different design scenarios and investigate their potential impact, including different housing design options; different heating and cooling options; and different transport scenarios. The analysis intended to provide "a baseline and guidance for strategically examining the effectiveness of strategies implemented at Aurora" (Centre for Design at RMIT and Global Footprint Network 2006, p. 5). The varying degrees of success that the tool had in delivering on these specific objectives is discussed in more detail in the sections below.

Worth

EFA is founded in an ecological world view that argues for the fundamental importance of maintaining ecological systems as the basis for sustainability. Wackernagel and Yount (2000:22) present sustainability as being made up of two imperatives: the "socio-economic imperative", requiring "an adequate quality of life for people all over

the world"; and the "ecological imperative", which states that providing this quality of life "must not be done at the expense of using the earth's bioproductive capacity beyond its ability to regenerate". Wackernagel and Yount (2000) therefore argue that two complementary sustainability accounting tools are required: one for monitoring the socio-economic sustainability imperative; and another for measuring the ecological imperative. These measures, they argue, should be kept separate to avoid the simplistic trade-offs that combined measures encourage, as achieving sustainability requires "both ecological health as well as social well-being, and achieving one at the expense of the other is inherently unsustainable" (Wackernagel et al. 2005:28). EFA is offered as a way of measuring the ecological imperative; that is, "tracking the overall supply of, and human demand on, life-supporting natural capital" (Wackernagel et al. 2005:3). It is not proposed as a comprehensive measure of sustainability but rather a tool that captures major global ecological concerns within its metric, reflecting an essential precondition for sustainability – living within the ecological limits of the Earth (Wackernagel and Rees 1996). Its creators acknowledge the additional need for social assessment frameworks (Wackernagel and Yount 2000).

The EFA methodology is based on concepts of ecological limits and carrying capacity. Put simply, it is an accounting tool – one that assists in the comparison of ecological supply and demand. On the supply side, the EFA methodology measures nature's bioproductive capacity. On the demand side, it measures a given population or economy's appropriation of this capacity through its consumption of goods and services and its production of waste – its ecological footprint. By calculating supply and demand in this manner, EFA aims to provide a vivid representation of the degree by which human consumption exceeds the regenerative capacity of the biosphere (Wackernagel et al. 2005; Wackernagel and Rees 1996; Wackernagel and Yount 2000).

To quantify ecological supply, the developers of the footprinting methodology have identified 11.2 billion hectares of bioproductive land globally. These 11.2 billion hectares are made up of various land forms, such as cropland, forest and grazing land. The different physical characteristics of these land-types naturally result in varying bio-productive capacities. To account for this variation, a common unit has been

established – the global hectare (GHa). The global hectare is not a measure of actual area, but a measure of relative bioproductive capacity. One global hectare is defined as equal to the average productivity of all 11.2 billion hectares of Earth's bioproductive land (Wackernagel et al. 2005). On the global scale, therefore, the 11.2 billion hectares of actual bioproductive area is equal to the 11.2 global hectares of bioproductive capacity. On a national or regional scale, however, these figures vary depending on the quality and quantity of bioproductive land present.

To quantify ecological demand, the ecological footprint methodology endeavours to "estimate the resource consumption and waste assimilation requirements of a defined human population or economy in terms of a corresponding productive land area" (Wackernagel and Rees 1996:9). To achieve this, it first attempts to quantify consumption and waste production by accounting for the flows of energy and materials to and from a defined population or economy. It then uses various calculation procedures to convert each resource and waste flow to an area of land required to sustain that flow; and then converts that area of land to global hectares. Once all resource and waste flows are expressed in global hectares they can be summed to give the total ecological footprint. The ecological footprint of a given population, then, represents the ecosystem area that is required to sustain it (Wackernagel and Rees 1996). Commonly this is compared with that population's proportional share of the world's available bio-productive capacity. A population that requires more bioproductive capacity to provide its goods and services than is available is described as being in ecological overshoot – "a state in which biological resources are used more rapidly than the biosphere can replenish them or assimilate their waste, thereby breaching the principle of strong sustainability" (Wackernagel et al. 2005:20)

In the EFA methodology, resource-consuming and waste-producing activities that consume the most global hectares have a greater contribution to the overall footprint calculation than activities that consume less land area. Therefore, revealing the way in which different consumption and waste production issues are prioritised within EFA requires detailed analysis of the calculation methods used to assess the impact of relevant activities, and the methods used to convert these impacts to the common unit of

GHa. This sets it apart from the other three tools analysed in this research in which issue focus is determined by the performance criteria to which developments are held to account. The issue focus of EFA, on the other hand, is a direct function of the calculation methods used to convert impact-causing activities to a bio-productive land area in global hectares.

The calculations used to make these conversions are neither simple nor, in many instances, uncontested. Converting specific human demands and/or waste flows to a productive land area is a controversial element of EFA, particularly for issues that don't have a clear relationship with appropriation of land (see van den Bergh and Verbruggen 1999; Ayres 2000; van Kooten and Bulte 2000). While the conversion of basic food crops, fibre crops and timber to productive land area may be relatively straightforward, the conversion of refined metals, electricity, fuel consumption, and toxic waste proves to be significantly more challenging. The following discussion elaborates on the coverage of issues in EFA, drawing on the objectives for operationalising sustainability in urban development developed in Chapter 3 (Table 2). It considers the treatment of both direct and indirect energy use, as well as other ecological issues of concern such as water cycle impacts and biodiversity. As EFA explicitly focuses on issues of ecological sustainability, coverage of quality and equality of life are not examined.

To include the impacts of energy consumption in a footprint calculation, consumption must be converted to the standard unit – the global hectare. The difficulty of converting either fossil fuel energy consumption or GHG production to the equivalent area of land needed to support it has resulted in much contention surrounding the three calculation methods that can be used: calculating the area of crops required to substitute ethanol for all fossil fuel use; calculating the area of land required to substitute biomass for fossil fuel use; or calculating the area of forest land that would have to be set aside to sequester the carbon dioxide pollution resulting from fossil fuel consumption (Wackernagel and Rees 1996). Ayres (2000:347) is critical of all three of these methods, pointing out that there are many other existing and emerging ways to sequester carbon dioxide that take up far less land (and therefore have a smaller footprint) than forest sequestration; that there are "other ways to generate useful energy without

producing carbon dioxide"; and that the "exclusive focus on carbon dioxide is topical but not necessarily justified" (see also van den Bergh and Verbruggen 1999). As a result, EFA is criticised for exaggerating the impacts of fossil fuel consumption, effectively prioritising this issue in comparison with other areas of ecological impact. In response to criticism of how energy consumption impacts are measured, the creators of EFA argue that the energy conversion approaches are not meant to imply that each is an alternative solution to the energy issue, but rather they illustrate "how much larger the world would need to be in order to cope with anthropogenic CO_2 emissions" (Wackernagel et al. 2005:16). They argue that the conversion of carbon dioxide waste to the forest land area required to sequester it represents the current prevailing method available to deal with greenhouse emissions. They acknowledge that there may be cheaper and less space-intensive methods which, if employed, could significantly reduce ecological footprints, pointing out that better sequestration technology "is an example of the very kind of option the footprint is intended to reveal" (Wackernagel and Yount 2000:26).

There is no conversion method, as such, to deal with indirect energy use, and this is a particular shortcoming when applying EFA in the assessment of urban development projects. To express the ecological benefit of progressive urban design and infrastructure provision in terms of the global hectare requires many assumptions to be made about the potential impact of urban form on human consumption behaviours. In a design evaluation scenario, logically and accurately modelling the effects of variables such as development location, infrastructure provision, services provision and urban design on the consumption and waste production of future residents, is highly complex and costly. Without the resources to attempt such modelling, the Aurora study trialled a variety of assumptions regarding the effects of strategic planning and infrastructure options on car use, and therefore, ecological impact. This amounts to a sensitivity analysis, investigating the effect of different development scenarios on the resulting ecological footprint. It does not, however, provide a detailed understanding of the causal relationship between each of the variables and its ecological impact. This is an example where the issue coverage of EFA is constrained by the quality and detail of the consumption and waste production data available (either modelled data in ex-ante

assessment, or measured data in ex-post evaluation of projects). Where such detailed data cannot be sourced, EFA has limited effectiveness as a design decision-support tool, or as a detailed performance evaluation tool.

In comparison to the consumption of fossil fuels and energy intensive goods and services, which tend to register strongly in a footprint calculation due to their treatment in the EFA methodology, other key areas of ecological concern highlighted in Chapter 3 (Table 2) – water cycle impacts, materials and solid waste, and biodiversity – tend to be marginalised. As EFA treats all bio-productive land as having equal significance (based on its bio-productive capacity), it does not cater well to location specific issues. In effect, it prioritises issues of global concern, such as climate change, over issues of local concern. This can encourage a trade-off mentality, as protection of one hectare of a locally significant, biodiverse ecosystem may have no greater impact in an EFA calculation than, say, reducing greenhouse emissions to the extent that one less hectare of land is required to offset emissions. In addition, any ecological benefit of protecting local biodiversity tends to be drowned out in the overall footprint calculation when all impacts resulting from human consumption are considered.

Water conservation and water sensitive urban design initiatives also tend not to register significantly in footprint calculations, as they have limited effect on the use of bio-productive land. This is because the harvesting of rainwater from catchment areas does not prevent the land being utilised for other ecological services, such as the carbon sequestration of closed catchment forests or the bio-productivity of farmland, and therefore does not register as a demand on bio-productive capacity. The impact of water consumption is therefore primarily based on the infrastructure required to provide potable water. The most significant element of this is the extent of electricity use in the manufacture (treatment) and circulation (pumping) of water. The result is that per capita water consumption levels have little impact on footprint calculations. This is well illustrated in the EFA of Aurora, where VicUrban has implemented a number of initiatives aimed at reducing water consumption. Modelling of the estate has predicted that Aurora residents will use 70% less mains water than residents in similar conventional developments, due mostly to the provision of recycled water to all homes

and the use of water efficient fixtures (McLean 2004). However, since the EFA methodology does not directly incorporate water saving into its metric, this substantial water saving translates to only an 11% reduction in the water supply footprint, attributed primarily to the decreased energy requirements for pumping (Centre for Design at RMIT and Global Footprint Network, 2006). As energy for water supply makes up less than 1% of an average resident's footprint, Aurora's water use reduction measures therefore have a negligible impact on its overall ecological footprint.

Rigour

A variety of methodologies for the application of EFA have evolved, and there exists extensive debate around the strengths and weaknesses of these different approaches (for example Wackernagel and Yount 2000; Ferguson 2002; Lenzen and Murray 2003; Wackernagel et al. 2005; McManus and Haughton 2006). In general terms, two distinct methodologies exist: the component method and the compound method. The component method bases footprint calculations on the summing of all the resources consumed, and wastes produced by a given population (Wackernagel et al. 2005). This 'bottom up' approach can quickly become unwieldy, requiring huge amounts of data to be sourced. The final results are highly dependent on the quality of this consumption data, as well as the accuracy of the life cycle modelling of processes and impacts (Lenzen and Murray 2003). The compound method, on the other hand, uses aggregated national and regional data (for example Australian Bureau of Statistics 2001; 2002) to estimate the total consumption of resources in a given area and allocates that consumption per capita (Global Footprint Network and The University of Sydney 2005). The major weakness of the compound approach is the lack of fine-grained detail. Increasingly, application of EFA incorporates both methods, with the component method used to provide detailed calculations of Ecological Footprint in areas deemed to be critical, and where good data is available; and the compound methodology used to provide the remaining footprint calculation elements.

As is increasingly the case, the Aurora study incorporated both the component method and the compound method in an attempt to overcome the weaknesses of each approach. The compound methodology was used to give the 'top down' big picture footprint

assessment, based on consumption statistics and assumptions regarding changed behaviour at Aurora compared to the Victorian average. In addition, detailed process-based life cycle assessment (LCA) was conducted on key components. The LCA analysis focused on the impacts of building materials, and on the life cycle impacts of household lighting, heating and cooling. These parts of the system were selected following a literature review indicating they were likely to be significant. This provided detailed 'bottom up' assessment of the specific impacts of different technology and design options.

In calculating the ecological footprint of a population, impact is commonly divided into five categories: services; goods; mobility; housing; and food. The Aurora study focused on modelling the change in two of these categories – mobility and housing – from the Victorian average. It was assumed that the consumption impacts related to food, goods, and services would remain the same for Aurora residents as that of the Victorian average. This assumption was made because of the inability to accurately predict future residents' consumption behaviour in these areas. In addition, it is not conventionally considered the role of an urban land developer to affect the nature and quantity of food, goods and services consumed.

To calculate the housing component of the footprint, detailed LCAs were conducted on the three basic housing construction types at Aurora, combined with energy performance modelling using Accurate (energy modelling software). To calculate the mobility component of the footprint, average transport use statistics for Melbourne were modified to incorporate predicted reductions in local vehicle trips due to urban design initiatives at Aurora. Various behaviour change scenarios were also examined to test the effect of rail provision to Aurora.

As a baseline for the study, the footprint of residents of a comparable greenfield development was calculated. This was based on the 2005 analysis of an average Victorian's footprint (Global Footprint Network and The University of Sydney 2005), with variations made to account for the urban fringe location and the recently mandated 5-star energy efficiency requirement for houses. A summary of the calculation

methodology is presented in Table 13. It highlights the focus on housing and mobility, and outlines the areas of focus within these categories, and the methods used for calculation. In addition, the table summarises the underlying assumptions made in the calculation process.

Table 13 – EFA calculation methods and assumptions for Aurora case study.

Footprint Categories	Components	Method and key assumptions
Housing	Construction	Calculations based on: • LCA of three different house types – terrace, semi-detached and detached. • LCA of key building material options including concrete, bricks, and timber. Assumptions: • 50 year house life assumed for LCA calculations.
	Space heating and cooling	Calculations based on: • Thermal modelling of houses to establish heating and cooling loads. • LCA of several space heating and cooling options.
	Water heating	Calculations based on: • LCA of hot water options: gas-boosted solar; conventional gas; and conventional electric. Assumptions: • Assumed Aurora water consumption was 20% less than conventional development a result of water efficient fixtures.
	Lighting	Calculations based on: • Lighting plans for the different house types being modelled.
	Water and waste water	Calculations based on: • Previous LCA of alternative water supply infrastructure options (Grant et al. 2005).
Transport	Urban design	Calculations based on: • Estimated changes in modal split from the outer suburban baseline, as a result of various design initiatives. Assumptions: • Assumed 25% reduction in local trips (less than 5km) due to urban design – focus on bike paths, walkability, proximity to services.
	Rail provision	Rail transport scenarios were considered, however, results were not included in the final analysis due to uncertainty regarding the provision of rail infrastructure.
Food		Calculations based on: • Victoria's per capita footprint. Assumptions: • That an average Aurora resident's food, goods and services footprint will be the same as that of an average Victorian.
Goods		
Services		

The baseline footprint – that of a comparable greenfield development to Aurora – was calculated to be 7.70 gha/capita/yr in 2006 (Centre for Design at RMIT and Global Footprint Network 2006). This is slightly less than the 8.10 gha/capita/yr for the average Victorian, and almost equal to the Australian average of 7.67 gha/capita/yr (Global Footprint Network and The University of Sydney 2005). The footprint of an average resident living in the Aurora development was found to be 7.03 gha/capita/yr – 9% less than the 7.70 gha/capita/yr baseline (see Table 14).

Table 14 – Component ecological footprints for resident scenarios.

Footprint Component	Average Australian resident (gha/capita/yr)	Average Victorian resident (gha/capita/yr)	Baseline – average resident of 5-star urban fringe development (gha/capita/yr)	Average Aurora resident (gha/capita/yr)	Aurora reduction from baseline
Food	2.73	2.97	2.97	2.97	0%
Goods	1.86	1.88	1.88	1.88	0%
Services	0.86	0.91	0.91	0.91	0%
Transport	0.82	0.8	0.82	0.75	9%
Housing	1.41	1.54	1.11	0.53	53%
Total	**7.67**	**8.10**	**7.70**	**7.03**	**9%**

(Centre for Design at RMIT and Global Footprint Network 2006)

In an EFA of Australian population, food, goods and services when combined make up 71% of the average person's total footprint while the housing and mobility components together constitute only 29% (Global Footprint Network and The University of Sydney 2005). In the Aurora study, food, goods and services were not considered, as it was assumed that living in the Aurora development would not result in significant deviation from Victorian averages. So, despite a 53% reduction in the housing component and a 9% reduction in the mobility component, the overall footprint reduction was calculated to be only 9%. The dominance of food, goods and services brings into question the usefulness of EFA in assessing the performance of MPEs. VicUrban's focus at Aurora, and therefore the focus of the assessment exercise, has been on housing performance, with attention also paid to mobility impacts. These are the areas where VicUrban, as an urban land developer, recognises its potential to effect substantial change. The scope of

Ecological Footprint, however, is far broader. When considering the impact of VicUrban's initiatives at Aurora, this broad scope has the effect of reducing the tool's sensitivity to changes in the housing and mobility fraction. It can also reduce the perceived effectiveness of initiatives that do have an impact, as they are 'drowned out' by external issues. The risk here is that in the context of internal and external economic and political pressures, environmental initiatives will be further marginalised, as the chosen measure of environmental success, Ecological Footprint, is showing little overall movement as the result of a given initiative.

Practicality

EFA remains a broadly utilised assessment methodology, that continues to evolve both via the work of its custodians at the Global Footprint Network and via numerous research projects and clusters around the world. It is most effective as an aggregated measure of the ecological impact of human activity at regional, national or global levels, as at these scales broad consumption statistics can be effectively utilised following the compound calculation method. However, when using EFA as a decision support tool in urban development, a much more detailed understanding of how different development scenarios will impact on ecological systems is required. This requires detailed data on consumption and waste production that can respond to subtle changes in the proposed project, and thus inform decision-making. Determining the effect of design decisions through rigorous modelling is time-consuming and costly. In practice, cost and time barriers regularly lead to significant assumptions being made, as evident in the Aurora study, which undermine the accuracy and validity of results. Time and cost issues also reduce the attractiveness of EFA as a decision support tool for industry.

Summary

EFA is clearly derivative of sustainability principles, focusing on the ecological dimension of sustainability and referencing principles of inter-generational equity and the precautionary principle. It aims to provide a direct measure of ecological impact and provides a clear end goal in its metric – achieving ecological footprints that are within the Earth's bioproductive capacity. EFA attempts to account for the actual ecological demand of production, consumption, and waste emissions; and to compare

this with ecological supply. Ecological availability is calculated through an estimation of available bio-productive land, expressed in a standardised unit – the global hectare.

When applied in an urban development context, the issue that attracts the most attention in EFA is the consumption of fossil fuels. Activities that have high GHG emissions (such as electricity use, car use, air travel and meat consumption) register strongly in the EFA metric, while activities that have minimal fossil fuel use, or intangible direct benefits to the global supply of bioproductive land, are less significant. Examples include water conservation, urban stormwater management, and protection of remnant areas of biodiversity.

As EFA is based on the calculation and conversion of ecological impact to a common unit, it is data intensive, requiring significant time and expertise to complete assessments.

Chapter 7: Discussion

Introduction

Attention now turns to a critical examination of the operationalisation of sustainability in MPEs, building on the analysis of tools presented in Chapter 6 and the review of relevant literature in earlier chapters. The cases in the previous chapter are used here as examples as part of a broader discussion of sustainability assessment of MPEs. This chapter begins by considering several key themes that have emerged from the analysis of tools. It provides an examination of the tools' engagement with sustainability principles and their coverage of sustainable urbanism objectives; and an examination of key sustainability assessment methodological issues, including methods of measurement and prioritisation. Building on this, the discussion then considers the critical weaknesses in existing assessment tools, in particular the limitations of incremental change. The discussion then broadens its focus to the context in which sustainability assessment tools are used, considering how they inform decision-making and effect change.

7.1 Better Sustainability Assessment Tools

Aspiring to sustainable urbanism – engagement with sustainability principles and objectives

In this thesis I have argued that there is a need to improve the performance of urban development and that sustainability theory provides a framework for understanding and operationalising the changes needed. Sustainability theory has a powerful potential to organise the often competing objectives of human development and environmental protection and preservation, and to be a catalyst for much needed changes in the ways cities are developed and function (Girardet 1999; Finco and Nijkamp 2001; Low et al. 2005). While it is acknowledged that there is considerable diversity in the interpretation of sustainability, and that implementation of sustainability principles necessarily embodies an element of subjectivity (Hodge 1997; Mawhinney 2002), sustainability is nevertheless a critical concept to engage with. However, as documented in Chapter 3,

sustainability and sustainable development are frequently misused and abused concepts, and the wide array of interpretations tends to devalue its conceptual power, effectively allowing sustainability to mean anything to anyone (Campbell 1996; Marcuse 1998; Low and Gleeson 2005). As such, any meaningful engagement with sustainability requires an explicit and transparent engagement with sustainability principles, and their interpretation within the given context (Lélé 1991; Hodge 1997; Diesendorf 1997; Mawhinney 2002; Connelly 2007). This provides certainty of purpose, and confidence that attempts claiming to operationalise sustainability are in fact derivative of sustainability principles and objectives. I argue here that the fundamental principles of sustainability are to improve the quality and equality of life, in a manner that does not diminish the ability of ecological systems to continue to sustain life; and that this is encapsulated in the principles of inter-generational equity (which has the preservation of ecological systems at its core) and intra-generational equity (which has social equity and quality of life at its core) (George 1999).

Following the burgeoning array of tools created to assess sustainability at the building scale, there has been steady growth over the last five years in the development of sustainability assessment tools targeted at an estate or precinct scale. The four tools examined in this research represent key examples of this growing field. All overtly engage with sustainability, but differ markedly in the degree and nature of this engagement. LEED-ND is the least concerned with an overt commitment to sustainability, focusing instead on new urbanism and smart growth as its founding principles, although it does make frequent reference to the contribution it can make to sustainable development. EFA, on the other hand, not only takes its lead from sustainability principles, declaring its focus on the ecological dimension of sustainability, it explicitly attempts to measure this in order to satisfy the principle of inter-generational equity. Sustainability principles, therefore, directly inform the nature of the tool, with its defined objective being to measure ecological demand against supply and to determine whether demand is within supply. The complexity of converting all ecological impacts to a common unit, however, causes many to question the ability of EFA methodology to meaningfully deliver on the tool's objectives. Lying between these levels of commitment to sustainability fundamentals are the

EnviroDevelopment and MPCT tools. Both claim their purpose as advancing the sustainability of urban development, but show little evidence of how this might be achieved in their statements of objectives. EnviroDevelopment's objectives are stated in very general terms which means that outcomes required to deliver on these objectives are unclear. MPCT's statement of objectives suffers from a lack of consistency, with some objectives (such as Commercial Success) succinctly defined and others lacking clarity of intent. Both tools do, however, directly structure their assessment criteria around their stated objectives, aiding internal consistency.

This lack of clearly defined objectives in tools leads to difficulty in determining how they have interpreted sustainability principles in the context of urban development. This is well-illustrated by the MPCT which, like the Charter before it, uses VicUrban's five core organisational objectives as the tool's objectives. While these objectives may have a relationship with issues that influence sustainability, they are not clearly derivative of sustainability principles. As organisational objectives, they have a clear focus on the nature of VicUrban's organisational structure, its business model, and its legislative requirements. The objectives are therefore framed according to what sustainability has been determined to mean for VicUrban, the organisation. There may be justification for using these objectives in the Charter, a tool designed for VicUrban's own in-house use. However, these same objectives are also used in MPCT, which is presented as a tool with industry-wide applicability. The objectives appear to have far less relevance in this context. The tool's substantial focus on Urban Design, for example, does not correlate with, or extend from, the goal of sustainable urbanism in any obvious way, nor is any attempt made to justify its prominence. The basis of the MPCT tool, therefore, appears to be in part a modified TBL framework, and in part an expression of VicUrban's operational objectives. This results in a lack of transparent and explicit engagement with sustainability principles as the foundation of the tool's objectives and criteria.

Examination of assessment criteria and associated scoring and weighting mechanisms within the tools reveals the extent of connection with sustainability principles and the significance allocated to them. It is evident from the case studies examined that the

functional interpretation of sustainability, as expressed by the issues covered and prioritised in the tools, varies significantly between tools. Moreover, due to their opaque form, issue coverage and prioritisation is not easily apparent to tool stakeholders.

The analysis in Chapter 6 presents an attempt to reveal issue priority by examining the criteria and metrics against the framework of objectives for operationalising sustainability in urban environments developed in Chapter 3 (Table 2). For the three criteria-based tools, issue focus is determined by the criteria used in the tool and the methods of scoring and weighting associated with them. For EFA, issue focus is a function of the methods used to calculate the impact of human activity. Table 15 provides a summary of the issue focus of the tools, with primary attention on the three criteria-based tools, although EFA is included at a broad level for comparison.

Table 15 – Summary of assessment tool issue focus.

<table>
<tr><th>Issue</th><th>Enviro-Development</th><th>MPCT</th><th>LEED-ND</th><th>EFA</th></tr>
<tr><td>Direct – Energy consumption and GHG emissions</td><td>17%</td><td>7%</td><td>15%</td><td rowspan="2">Significant coverage</td></tr>
<tr><td>Indirect – Energy consumption and GHG emissions</td><td>6%</td><td>23%</td><td>39%</td></tr>
<tr><td>Water cycle impacts</td><td>21%</td><td>5%</td><td>20%</td><td rowspan="3">Coverage dependant on embodied and lifecycle GHG emission; and direct impact on bio-productive land</td></tr>
<tr><td>Materials and solid waste</td><td>34%</td><td>3%</td><td>2%</td></tr>
<tr><td>Biodiversity and ecology</td><td>13%</td><td>4%</td><td>7%</td></tr>
<tr><td>Increase quality of life</td><td>7%</td><td>4%</td><td>1%</td><td rowspan="2">No coverage</td></tr>
<tr><td>Increase equality</td><td>4%</td><td>21%</td><td>5%</td></tr>
<tr><td rowspan="2">Other areas of significant focus (>2% of tools focus)</td><td rowspan="2"></td><td>Commercial success (20%)</td><td>Location for urban consolidation (6%)</td><td rowspan="2"></td></tr>
<tr><td>Urban design (12%)</td><td>Protection of local agriculture (5%)</td></tr>
</table>

The proportional allocations documented in Table 15 reveal both the particular issues covered in each tool, and the proportional differences between tools. It does not, however, provide an absolute measure of priority, as all of the criteria have different levels of impact. For example, 10 'weak' criteria in one issue (easy to achieve and with little impact) would not represent a 10-fold prioritisation when compared with one mandatory 'strong' criterion in another (requiring significant change and having significant impact). As such, the significance of the requirements specified in each criterion was also examined; this is elaborated upon in the discussion of issue focus below.

Table 15 reveals that EnviroDevelopment is primarily focused on the conventional areas of environmental impact – energy, water, materials and waste, and biodiversity protection – while LEED-ND considers these along with broader strategic planning issues through a focus on reducing urban sprawl and indirect energy consumption through urban form. MPCT in comparison has less focus on ecological issues, with significant attention paid to housing affordability, commercial success and urban design, along with the environmental impact categories. In fact, as Table 16 shows, MPCT has a far greater focus on issues relating to the socio-economic dimension of sustainability (58% of the tool's overall focus) than do LEED-ND, EnviroDevelopment and EFA (10%, 6% and 0% of the tools' overall focus respectively). Although it should be noted that several of the criterion in each of LEED-ND, EnviroDevelopment and MPCT that are attributed to the ecological dimension also affect the socio-economic dimension, such as those focused on improving walkability, which has both environmental and liveability benefits. As such, the skew toward issues of the ecological dimension is somewhat overstated in this analysis; however, since the allocation of criteria to issue areas was consistent across all of the tools examined, the stark difference revealed between MPCT and the other tools in terms of issue focus remains significant.

Table 16 – Summary of issue focus against sustainability principles.

Issue	Enviro-Development	MPCT	LEED-ND	EFA
Issue focus relating to ecological dimension of sustainability	90%	42%	94%	100%
Issue focus relating to socio-economic dimension of sustainability	10%	58%	6%	0%

MPCT's focus on issues relating to the socio-economic dimension is exemplified by its coverage of housing affordability (18% of the tool's overall focus) compared with LEED-ND and EnviroDevelopment (4% and 3% of the tools' overall focus respectively); and of commercial success (20% of the tool's overall focus, compared with no such coverage in the other tools). The attention on housing affordability ensures a degree of socio-economic diversity in development, and reflects an attempt by the creators of MPCT to avoid 'sustainable' development becoming a niche market available only to more affluent consumers. The criteria addressing housing affordability in EnviroDevelopment make up two of 13 under the 'Community Design' headline criteria in the Community element, of which only six must be achieved to meet requirements for certification. As a result, a development can be fully certified under EnviroDevelopment without any attention paid to diversity in socio-economic profile, as highlighted by the Mebbin Springs example outlined in Chapter 6.

EnviroDevelopment has a substantial focus on materials and solid waste issues (34% of the tool's overall focus) in comparison to MPCT and LEED-ND (3% and 2% of the tool's overall focus respectively). Within the solid waste component of EnviroDevelopment, nearly all measures focus on minimising construction waste. Construction activity, and the waste it generates, is certainly of environmental concern, and it is an area over which developers can have direct influence with relative ease. However, in the context of achieving sustainable urban development, the extent of focus on this issue is arguably disproportionate to impact, and there is no attempt to justify this dominant focus on construction waste.

Nearly half of LEED-ND's focus is on local and regional urban efficiency, via neighbourhood design and layout to encourage walking, cycling, and public transport usage (39% of the tool's overall focus); and on the location of development with respect to existing urban form and infrastructure (6% of the tool's overall focus). This demonstrates a strong emphasis on the role that a given development plays in its urban context, rather than the 'green credentials' of the buildings, infrastructure, and public spaces within the development boundaries. Indeed, this intended focus is declared in the tool:

> Unlike other LEED rating systems, which focus primarily on green building practices and offer only a few credits for site selection and design, LEED for Neighborhood Development places emphasis on the site selection, design, and construction elements that bring buildings and infrastructure together into a neighborhood and relate the neighborhood to its landscape as well as its local and regional context (USGBC 2009:xii).

There is a clear distinction evident here between EnviroDevelopment and MPCT, on the one hand, and LEED-ND on the other. LEED-ND, founded on the principles of new urbanism and smart growth, has a strong focus on site assessment and location of development. It draws on a particular view on how cities should work, be organised, and grow; and infuses the tool with performance criteria in response to this.

LEED-ND, therefore, starts from a strategic planning perspective. Its focus is not just on how sustainable the development can be, but on how sustainable the development can be *as part of a more sustainable city*. Rather than treating the development in isolation, it treats it as a component of the urban area it will become part of. Thus the tool rewards development that capitalises on existing urban infrastructure; reduces pressure on undeveloped land; protects local agriculture; demonstrates high connectivity with existing urban form; and locates on infill or brownfield sites. The strong locational focus of the criteria in LEED-ND makes it easier to achieve certification for an urban redevelopment project than it does for a greenfield development. As such, LEED-ND is more commonly being utilised by developers of brownfield and urban redevelopment projects (Criterion Planners, 2007).

In contrast, EnviroDevelopment and MPCT pay limited attention to how a development interacts with the surrounding urban areas, region and city as a whole.

EnviroDevelopment has limited coverage of criteria addressing the proximity of development to services and transport, and optional criteria that reward developing on a brownfield site. MPCT has several criteria focusing on accessibility for residents, with criteria rewarding the provision of access to jobs, services, entertainment, retail and recreational facilities, and the provision of employment options and services locally. There are, however, no measures concerning the selection of preferable sites for development in the context of regional issues. Therefore both EnviroDevelopment and MPCT are more concerned with the specific and discrete impacts of a given development, rather than the role of a development in a regional strategic planning context.

This substantial difference in focus between the tools reflects the organisational purposes of the agencies involved. LEED-ND was created by a non-profit agency and informed by the objectives of new urbanism and smart growth, which both have a strong strategic planning focus. EnviroDevelopment was created by UDIA, a developer peak body, while MPCT was created by a corporatised government agency with a commercial stake in the development industry. A lack of limitations on land for development in these tools reflects the motivations of a developer peak body and a land development agency which has significant interest in new development on the fringes of cities. With LEED-ND, sustainability principles lead to the conclusion that projects should be focused on infill development, urban redevelopment or, at the very least, development near high quality existing services. From a developer perspective, a tool that encourages improved performance within a development is more desirable than a tool that engages with development in the broader urban context and thereby rules out development in many locations.

The issue focus of EFA is deliberately directed at the ecological dimension of sustainability. However, the scope of ecological impacts evaluated in EFA is much broader than those traditionally considered in urban development initiatives. Essentially, the Ecological Footprint is a consumption metric with higher consumption resulting in a larger footprint. It highlights the pressing problems of high levels of consumption and of global inequalities in consumption, and points to opportunities to

consume less. In urban development projects, the focus is typically on reducing the embodied impact of the built infrastructure delivered; providing infrastructure that encourages minimal consumption and impact in its operation; and providing services and spatial layouts that provide the potential for reduced mobility impacts. While EFA is sensitive to these initiatives, the consumption of food, goods and services also feature significantly in its metric. It also has little sensitivity to several issues typically deemed important in regional ecological sustainability, such as reducing impacts on the water cycle and protecting local biologically sensitive regions as discussed in Chapter 6, The combination of these shortcomings limit the usefulness of EFA in this context, as a decision support tool. It is difficult to evaluate different development scenarios when elements deemed important in operationalising sustainability in MPEs do not register significantly in the EFA metric.

The fundamental principles of sustainability do not appear to be well understood or addressed in the three criteria-based tools examined in this research as highlighted in the previous analysis. The way in which these concepts are interpreted and used to inform the intent and functionality of assessment lacks clarity, with none of the assessment tools transparently outlining what sustainability or sustainable development is taken to mean in their particular context. The use of the terms sustainability and sustainable development are adopted uncritically as if to present unquestioned validity of purpose. Without this engagement with principles, it is not clear what is driving the development of the tools' mechanisms – that is, their criteria and their methods of scoring. It is up to the user, then, to discern the interpretation of these concepts via examination of the assessment framework, criteria, and procedures for use.

It is also evident that the coverage of sustainable urbanism objectives in existing criteria-based tools varies significantly. Objectives are not clearly derivative of sustainability principles, and there is limited attempt to justify why the particular issue focus of a tool appropriately reflects the needs of sustainable urbanism. This diversity of issue focus is part of the problem facing the operationalisation of sustainability, particularly in instances where there is limited engagement with definitions or principles of sustainability. In such cases, the criteria themselves become a proxy definition for

sustainability and, through the determination of these criteria, the developers of the tools are effectively creating their own definitions of sustainability and using these to set the agenda for the operationalisation of sustainability in urban development. Ultimately, this makes it very difficult for an independent observer to ascertain how tools position themselves in relation to sustainability, and therefore difficult to judge, and accept, their intent and integrity.

It is critical that attempts to operationalise sustainability make clear from the outset what sustainability is taken to mean in the particular context, and what it is hoped will be achieved. A meaningful and significant engagement with principles of sustainability should drive the development and logic of the assessment approach, with the impact of the tool ultimately reflecting this (George 1999; Gibson 2000; Mawhinney 2002; Pope 2003). Without this, sustainability assessment tools risk contributing to a continued devaluing of terms such as sustainability and sustainable development, through drifts in meaning and absence of definitional clarity (Lélé 1991; Sutton 2004; Hopwood et al. 2005; Connelly 2007). Their vagueness and ambiguity is both confused and confusing. It also raises concerns that the language of sustainability is being co-opted to justify and solidify status quo approaches to development (Low and Gleeson 2005; Connelly 2007; Gunder and Hillier 2009); and further that this is a deliberate strategy to divert and delay critical attention of existing practice (Luke 2005).

Attributing value – measurement and prioritisation

The analysis of issue focus, discussed above, sheds some light on how different functional aspects of sustainability are prioritised by different tools. A further degree of prioritisation occurs via the tools' mechanisms of measurement (Paracchini et al. 2008; Retzlaff 2009). In criteria-based assessment, issues are prioritised with the use of prerequisite criteria or hurdle marks and through the allocation of value via points scoring mechanisms. The use of such mechanisms reflects a recognition that each issue covered, or criterion listed, is not necessarily equal in terms of its contribution to the overall tool objectives – that some areas are more significant than others in achieving sustainability gains (Paracchini et al. 2008). The degree of flexibility that a tool provides through allowing users to 'trade-off' success in one area against lack of

performance in another, also affects prioritisation. Flexibility tends to reduce the prescriptiveness of a tool, effectively allowing some mechanisms of prioritisation to be devalued, or bypassed altogether. For sustainability assessment to be effective, therefore, prerequisites and hurdle marks should be targeted at those issues that are identified as critical to the implementation of sustainability in urban development; scoring mechanisms should reflect the significance of each individual criterion in improving the sustainability of the development; and flexibility should allow innovation in response to assessment, without providing so much leeway as to inhibit a meaningful contribution to sustainability.

The four tools examined represent a range of approaches to attributing value through prioritisation. Three of the tools, LEED-ND, EnviroDevelopment and MPCT ascribe value in a manner typical of criteria-based tools, while EFA, which attempts to directly model or measure ecological impact, allocates priority directly through its calculation metrics. Table 17 provides a summary of these tools' approaches to attributing value, with the following discussion elaborating first on the criteria-based tools, and then on EFA.

LEED-ND and EnviroDevelopment make significant use of prerequisite measures. By designating some criteria as mandatory, thereby prioritising these issues, the tools take some of the decision-making about which criteria to comply with out of an applicant's hands. All prerequisite criteria in LEED-ND are compulsory, and even the most basic level of accreditation cannot be achieved without first satisfying these criteria. EnviroDevelopment takes a different approach, with prerequisites allocated across the six element areas, allowing a project to be accredited individually in each element area without necessarily paying any attention to the objectives, and therefore the prerequisites, in other element areas. LEED-ND therefore takes a more holistic approach to improving performance, leaving little room for selected 'specialisation', while EnviroDevelopment accommodates developments that have a specific issue focus.

Table 17 – Summary of approach to attributing value.

Tool	Approach to allocation of priority	Ability to trade-off
LEED-ND	• Each section identifies several prerequisite measures, all of which are compulsory to achieve certification. • Each section also contains optional criteria. • All optional criteria have points allocated to them. • Points accumulated in each section contribute to the overall assessment score. • Overall assessment score results in certification at basic, silver, gold or platinum level.	• Unrestricted trade-off of points for optional criteria between sections, providing flexibility. • Use of prerequisites in each section limits trade-off between issues.
Enviro-Development	• Each section identifies several prerequisite measures, which are compulsory to achieve certification in that section. • Each section also contains optional criteria, of which a specified proportion must be met to achieve certification in that section. • There is no allocation of points for optional criteria, which are therefore all equally weighted.	• No ability to trade-off between the six sections of the tool.
MPCT	• Each section made up of optional criteria. • All criteria have points allocated to them. • Points accumulated in each section contribute to the overall assessment score. • No use of prerequisite criteria.	• Unrestricted trade-off between the five sections of the tool.
EFA	• Quantifies ecological impact of activities, thereby directly aligning priority with impact. • Calculation of impact is based on converting impact of activities to a common unit – the global hectare.	• No ability to trade-off between objective areas.

MPCT has no prerequisites or hurdle marks, which is a significant change from its predecessor, the VicUrban Charter. In the Charter, criteria are allocated a minimum and a maximum score. While the majority of performance measures have a minimum score of zero, many also have a required minimum score greater than zero, effectively meaning the criteria have a mandatory level of compliance. Some have the minimum score equal to the maximum score, meaning that full compliance with the criteria is mandatory. The elimination of hurdle marks in the MPCT demonstrates an effort to increase the flexibility with which the tool can be applied. It also, however, results in an inability to convey the importance of minimum standards in a particular criterion in the delivery of overall objectives, and no capacity to mandate those standards. It

therefore eliminates any notion that some things are too important to trade-off when attempting to operationalise sustainability in MPE development.

Another mechanism that affects the flexibility of a tool is the extent to which points scored towards accreditation are associated with particular issues. In EnviroDevelopment, for example, because developments are accredited in each element separately, each criterion met can only contribute to compliance within that particular element. Extra achievement in the Water element, for example, cannot be used to help score enough points to acquire the Energy element. Therefore the level of certification clearly indicates where the developer has good performance, and where they do not meet requirements; but does not give any indication of the extent of achievements, other than confirmation that minimum standards have been met. The MPCT and LEED-ND take a different approach, with the overall score awarded signifying the level of performance. This gives an indication of 'good, better, best' performance across the tool, but not on the particular strengths and weaknesses that make up the overall score, thereby permitting a degree of 'trade-off' between the level of engagement with different issues.

This is of particular relevance when a tool covers a broad range of issues in its interpretation of sustainability, such as in MPCT. In contrast with EnviroDevelopment and LEED-ND, MPCT has a large component of criteria focused on commercial issues. Without mechanisms in place to regulate how the overall score is achieved, high achievement in commercial success could come at the expense of one or more of the other issue areas. The result of this is that developer focus can shift away from the areas which require the greatest degree of effort and change and, arguably, have the most significance with regard to improving environmental and social performance. Taking energy consumption as an example, a developer could easily achieve a significant total score in MPCT without having to make any commitment to implementing energy reduction measures. With EnviroDevelopment, a similar lack of energy reduction measures would be evident in the level of certification, since the energy element of the tool requires mandatory energy reductions, and therefore the development could not achieve certification in that element. While in LEED-ND, prerequisite criteria with

minimum energy efficiency improvements limit the opportunity for trading-off between energy and other issues.

By not accrediting each objective area separately, tools can effectively allow, and even encourage, trade-offs between the different objective areas, since they only award a final aggregated score. Therefore, assessment tools that allow summative assessment of value across domains risk glossing over the unique challenges inherent in the constituent issue domains. This is exemplified by MPCT and LEED-ND which allow summative assessment across issue domains to produce the final assessment score. A significant difference with LEED-ND, however, is that, as discussed above, it has minimum requirements in each of the issue domains it covers via its comprehensive use of prerequisite criteria. In contrast, MPCT allows for accumulation of points across all domains in determining the final assessment score. This creates a great deal of flexibility for a developer to focus attention anywhere across the five objective areas of the tool, with no requirement for minimum attention in any of the areas. For example, a developer could choose to excel in economic performance and design excellence, at the expense of environmental and affordability issues. As such, none of the criteria presented are viewed as a compulsory action for the delivery of sustainable MPEs. This is a notable increase in flexibility from the VicUrban Charter, which has a minimum target score of 60 points (out of 100) in each of the five objective areas, in an attempt to facilitate increased performance across issues.

In applying the Charter and MPCT to its own development projects, VicUrban has extended the flexibility of the tools even further, by allowing trade-offs between discrete projects. The 2007/08 annual report states that in achieving its sustainability objectives VicUrban adopted a "portfolio approach … with a balance across each development project contributing to the overall result" (VicUrban 2008:15). As such, it appears that it is acceptable for individual developments to underperform in several areas, as long as each area has some level of engagement across the portfolio of VicUrban developments.

Assessment approaches like MPCT, which have a broad issue coverage, extensive flexibility in application, and a lack of prerequisite measures, are criticised for encouraging trade-offs which typically result in economic imperatives being prioritised over social and environmental imperatives (Gibson 2000; Buselich 2002; Pope 2003; Sutton 2004). Cumulative scoring approaches that use additive indicators across environmental, social and economic domains tend to obscure the many inherent conflicts between these domains (Hueting and Reijnders 2004; Wackernagel et al. 2005). Rigorous assessment requires that the results of assessment adequately highlight where these conflicts lie and therefore where the necessarily value-based trade-off decisions have been made. In a domains approach, this is best achieved by keeping evaluation processes separate, or at the very least ensuring that the overall scoring mechanism clearly indicates achievement in each of the constituent domains. In this way, critical decisions about how to best improve sustainability performance within resource constraints are informed by a rigorous evaluation of the potential ecological and socio-economic impacts of all elements in a given project proposal.

The removal of minimum objective scores and criterion hurdle marks from MPCT, and VicUrban's adoption of a portfolio approach to assessment, reflects the development industry's desire for flexibility in the sustainability assessment of projects. There are merits to flexibility: it can increase the practicality of implementing tools, by better suiting the particular needs of individual developments and projects; and it can allow for creative responses to issues and encourage innovation. The creators of EnviroDevelopment, for example, describe the "careful balance [that] was required … to ensure that EnviroDevelopment [would be] flexible enough to encourage innovation and broad application, [and] be straightforward for consumers to understand with little interpretation" while also delivering "enhanced sustainability outcomes and the perception of this by all stakeholders" (Plant et al. 2006:309). They go on to point out that the tool is "designed to encourage flexibility and foster a proactive culture of innovation and environmental benevolence, it is performance-based and can be adaptable to a range of development types and situations" (Plant et al. 2006:309). Rather than resulting in innovative and unexpected solutions, however, excessive flexibility can simply give licence to a continuation of current practice. The use of

prerequisites in LEED-ND and EnviroDevelopment ensure that a minimum level of performance in certain areas is achieved in order to meet the tools' objectives. Without these, a developer is free to pick and choose criteria, increasing the temptation to find the path of least resistance to accreditation by choosing the criteria that are easiest to comply with. In the case of MPCT, its increased flexibility diminishes the ability of the tool to distinguish between meaningful improvement and status quo development.

EFA takes an entirely different approach to determining priority than the criteria-based tools discussed above. It is one of the few existing tools being used to assess MPE development which uses a systems-based approach to sustainability assessment. EFA establishes a quantifiable unit of impact – the global hectare – giving extensive justification as to why this is a valid proxy measure for ecological impact. The application of the tool involves a calculation of the ecological impact of development using this metric. In contrast to criteria-based approaches, the EFA methodology provides a clear measure of the significance of actions by estimating actual impact (ecological demand) and then comparing this with current practice and with the sustainable supply of ecological capacity. In this way, both current and proposed performance can be compared with an end goal – a footprint within sustainable limits. This clearly contextualises the significance of proposed improvements, and the extent of change still required to meet the end goal of ecological sustainability. It is important to note, however, that EFA explicitly focuses only on the ecological dimension of sustainability, excluding consideration of socio-economic factors.

The allocation of priority in EFA is based on quantification of impact. Issues which translate to the greatest consumption of global hectares are those which receive greatest priority in the tool. As discussed in Chapter 6, activities that involve high energy use or direct consumption of land tend to register strongly, while activities such as water consumption and waste management register little significance. EFA therefore prioritises issues of energy consumption and food consumption (Global Footprint Network and The University of Sydney 2005). Whilst food consumption is undoubtedly of great significance when regarding the overall impact of human activity, it has less relevance when applying EFA at the urban development project scale, where

food consumption is arguably not within the scope of a project's influence. On the other hand, marginalised issues in EFA such as local biodiversity and water cycle impacts are of significant importance in the context of local sustainability. Importantly, these are also areas over which urban developers often have influence, and therefore have the capacity to effect significant change.

The complexity inherent in attempting to quantify the impact of human activities and the capacity of the earth to sustain such activities, means that the EFA calculation methodology is dependent upon many assumptions. When estimating aggregated supply and demand at global, country or even city scale, such assumptions may be acceptable. However, when EFA is translated to the project scale, with results aiming to inform detailed decision-making on project planning and design, these assumptions can limit the utility of such results. This is demonstrated by the Aurora EFA study discussed in Chapter 6.

It is evident from the cases examined that methods used to attribute value in sustainability assessment tools are frequently opaque in operation, and based on limited justification. Further, prioritisation is often not clearly aligned to the potential for improving sustainability outcomes; and flexibility provided in scoring mechanisms can undermine achievements by allowing little or no commitment to meaningful change in critical areas of impact. In assigning value in sustainability assessment, it is critical that mechanisms for scoring, weighting and trade-off are transparent; and that they are justified in terms of their capacity to allocate priority to actions that best facilitate improved sustainability outcomes. In criteria-based tools, prerequisites and hurdle marks, whether performance-based or prescriptive, are important mechanisms for establishing minimum sustainability standards.

7.2 Limitations of Incremental Change

Criteria-based tools, such as LEED-ND, EnviroDevelopment and MPCT, are developer-focused, aiming to facilitate better outcomes by intervening in the planning and design phases of urban development. They are practical in application, acting as decision support tools which attempt to interpret sustainability by distilling complex issues into

checklists of criteria which can be considered in a given development. In this way, they bypass the need for project teams to consider the full complexity of sustainability principles in the urban development context. Taking current practice as a starting point, they present criteria that are typically within the limits of what is currently commercially achievable, seeking to encourage outcomes beyond current mainstream practice. They thus present an incremental approach to improving the sustainability performance of MPE development. This approach typically minimises time and resource requirements, as well as the need for particular expertise, all keeping down the costs of engaging with the tool. In a sector where the financial bottom line is paramount, tools that simplify planning and design are often crucial in encouraging the inclusion of voluntary sustainability initiatives.

However there is inherent conflict between helping to incrementally extend current practice and providing opportunity for significant and meaningful change. In these incremental checklist approaches it is difficult to discern the *significance* of each action. It is often unclear whether compliance with a given criterion equates to regulatory compliance, marginal improvement, or something more significant. Furthermore, there are no mechanisms to indicate the significance of actions within the context of a transition to sustainable urban development practices. That is, there is no sense of an end goal, and therefore no understanding of the significance of each criterion – or criteria in combination – in the context of that end goal. These criticisms lead to assertions that criteria-based tools merely present lists of options that may lead to improvements, rather than offering any true assessment of sustainability performance. Pope (2003:12) suggests that TBL assessment frameworks in particular generally "avoid attempting to define criteria or conditions for sustainability, and limit themselves to minimising negative triple bottom line outcomes or maximising positive ones". This type of assessment may indicate improved performance upon current practice, but does not indicate whether the subject of assessment could be considered sustainable, or what would need to be changed to deliver a sustainable outcome.

To significantly reduce the ecological impacts of urban development, it is not sufficient to just improve on current practice and move 'towards' sustainability. It is also

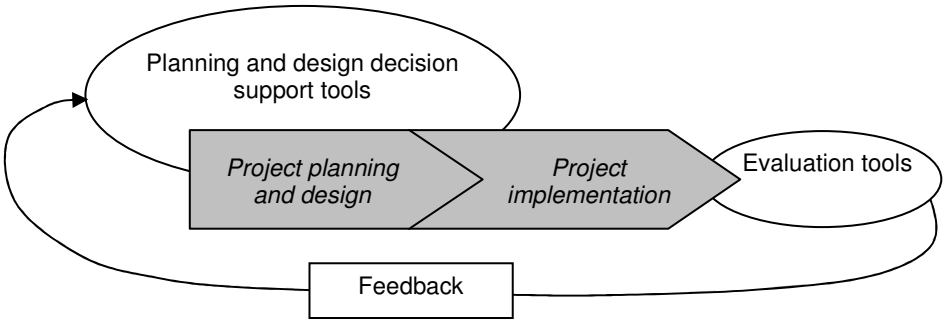
essential to consider the extent of the challenge, and to set target goals to meet that challenge (Sutton, 2007). This is required to ensure that short-term strategies contribute to meeting longer term goals in a meaningful way. While the criteria-based tools analysed may contribute to improved sustainability performance, they are weak on framing these actions within the context of target goals. They present relative assessment frameworks, with scoring metrics that are not clearly linked to measurable ecological outcomes. While this may be useful for monitoring improvement upon past practice, it provides little robust evaluation of success.

Sustainability assessment must be able to both guide progress, to effect real improvements now through incremental processes; *and* assess and evaluate change against current practice and against end goals (and transition goals), to ensure improvements are significant in the face of the overall problem or issue. Tools are needed that fully describe the problem (the unsustainable nature of urban development) and present the real nature of the challenge, opening up the way for the transformative change that is needed. As McManus argues, we should not shy away from setting goals that might prove to be "unattainable", as for outcomes "to be 'ecologically meaningful' … it is important to develop appropriate yardsticks for sustainability, and then to work towards them" (McManus 1996:69). To be effective in solving real problems within required timeframes, change must be referenced to the targets that need to be met.

With existing criteria-based tools there is no attempt made to justify the criteria in terms of how far they extend on current minimum, average, or best practice standards, or in terms of what might be considered sustainable practice, either in quantitative or qualitative terms. This lack of engagement with sustainability goals is often reflected in the practical requirements of the tools' criteria. This is well-illustrated by EnviroDevelopment's focus on reducing proximity to local services in order to reduce private vehicle use. As revealed in Chapter 6, its loose definition of local services combined with a low hurdle mark mean that most conventional subdivisions would, in fact, already satisfy these requirements – so meeting this particular criterion is unlikely to have any effect on the dominance of the private vehicle in new residential development. Similar ambiguity exists in MPCT's criterion targeting sustainable

transport, which constitutes one of the largest points allocation of any criteria in the tool. It requires the developer to create and integrate a 'sustainable transport plan', but there is no specification of what modes constitute sustainable travel or what targets may be appropriate; and no potential to measure success other than the existence of such a document. Further, as Chapter 6 highlighted, the use of several proximity targets for access to public transport that existed in the Sustainability Charter were removed in the tool's transition to MPCT. The tool takes a similarly vague approach to biodiversity protection, with the relevant criterion requiring only that a study be completed.

Figure 11 – Assessment tools in urban development projects.



For sustainability assessment approaches to be effective, they must facilitate improvement in sustainability performance. In the delivery of MPEs this requires tools that provide ex-ante assessment, to help inform decision-making in design and master planning. However, it also requires ongoing and ex-post evaluation of project outcomes to ensure delivery on design intent (Roberts 2006; Oliveira and Pinho 2010). Figure 11 illustrates these key components of assessment, along with a further critical component – a feedback mechanism connecting outcomes of project evaluation back to the development and continual improvement of ex-ante tools. In planning and design decision support, tools act in a facilitative role, providing practical interpretations of sustainability in urban development and presenting potential options for action. In the evaluation of progress, tools must be able to measure the success of these initiatives against a robust evaluative framework, with a transparent theoretical basis. Effective evaluation provides both assessment of improvement upon previous practice, as well as assessment of progress towards target sustainability goals. In the provision of feedback, evaluation tools provide essential information for ex-ante tools, evaluating actual

outcomes versus expected outcomes, ensuring relevance and facilitating continual improvement (Bond and Morrison-Saunders 2011; Rametsteiner et al. 2011).

Incremental management frameworks such as LEED-ND, MPCT and EnviroDevelopment are particularly effective at informing project decision-making. They provide lists of understandable actions, across a broad range of key issues, to consider throughout the development delivery process. Whilst being practical in application, however, incremental tools typically lack the ability to evaluate the significance of achievements against physical measures of impact, or against established sustainability goals. This lack of evaluative capacity also results in a lack of feedback confirming the validity of the assessment frameworks.

EFA provides a number of key elements lacking in existing incremental approaches, as the Aurora case study demonstrates. It provides a robust and highly scrutinised assessment methodology that attempts to quantify the ecological impacts of development and compares that to available biocapacity. It thereby allows not only assessment of impact, but an expression of that impact in the context of a target goal – that is, a population living a lifestyle that is within the regenerative limits of the Earth's biological capacity. As such, it provides the ability to evaluate significance of achievements, rather than just give indications of incremental improvement. However, the scope of Ecological Footprint does not neatly match the scope of environmental concern attributed to MPE development. This limits its usefulness, especially as a decision support tool, as it is difficult to evaluate different development scenarios when elements deemed key in considered alternatives are missing from the assessment metric.

While criteria-based tools offer a means of facilitating and assessing incremental improvement upon existing practice, they have limited capacity to determine the significance of improvements achieved or to place this within the context of target goals for sustainable urbanism. Examination of the use of EFA in the sustainability assessment of MPEs demonstrates that it is inappropriate in scope and too complex in methodology to effectively aid decision-making in design and planning of MPE development projects, but provides an important contribution in areas where criteria–

based tools are weakest, based as it is on quantitative assessment of impact against defined target goals of ecological sustainability. To make a meaningful contribution to improved sustainability performance of MPEs, sustainability assessment must be able to facilitate decision-making in planning and design to bring about changed outcomes; but critically, this must be based on a meaningful engagement with the requirements of sustainable urbanism, and make the significance of change transparent in the context of these requirements. They must be integrated with mechanisms to track progress and evaluate final outcomes to ensure that projects deliver on intent, and enable critical evaluation of ex-ante tools, ensuring integrity and providing for continual improvement.

7.3 Considering Tools in Context

The discussion above outlines critical findings of this thesis in regard to the integrity and effectiveness of assessment tools in operationalising sustainability in MPE development. However, sustainability assessment tools alone cannot facilitate the implementation of sustainability. Rather, they are mechanisms to help interpret complex issues in a specific context to aid decision-making. It is critical to consider such tools in the context of their use, and to recognise that both physical/technical responses and *institutional* responses are required to effectively address the problems of sustainability in our cities. A tool, no matter how rigorous, is limited in its effectiveness by the process within which it acts and the nature of its engagement with the various actors in that process. The contribution of sustainability assessment tools to sustainable urbanism, therefore, is not necessarily aided by more, or better, tools. Ultimately it is the ability of tools to create changed practice that will contribute to more sustainable cities and this is a function of the tool's integrity and its ability to impact on the existing development delivery process.

It is important, therefore, to identify the actors and agencies affecting the development delivery process, and to question how intervention in this process might generate sustainability outcomes. In Chapter 2, Minnery and Bajracharya's (1999) framework was drawn on to discuss the development delivery process and consider relevant actors and their influence on the planning approval process (Figure 2). The central actor in this process is the land development company which is the proponent of the MPE

project. The primary roles of the developer are in design, master planning, and development delivery. Both state and local government also have a critical role to play, providing development approval through the planning approval process. Local government also typically communicates with the developer during master planning to direct development towards strategic planning objectives. Minnery and Bajracharya identify industry lobby groups and community groups as further influencing the delivery of MPEs. These groups act outside of the developer/planning approval authority relationship, but can exert significant influence on the development delivery process. The role of industry peak bodies is to support the industry and represent the industry's interests to government and other stakeholders. In the context of urban development, industry groups such as the HIA and UDIA wield significant influence (Gleeson and Low 2000; Hamnett and Kellett 2007; Grant 2009), and constantly exert pressure to reduce government regulation (Cooke 2005; Day 2006). Independent organisations developing sustainability assessment tools can be considered part of this group of actors, being external to developer and planning approval activities, but potentially exerting influence on development outcomes. The following discussion elaborates on these actors/agencies in the context of sustainability assessment of MPEs, first examining the role of industry and independent sustainability assessment tools and then considering the role of government.

In Australia, a significant role in the sustainability assessment of MPEs is played by industry, with established assessment tools developed by UDIA, the national urban development peak body, and VicUrban, a corporatised government land development agency; and more recent contributions from other land development agencies and private sector businesses (see Varshney et al. 2009; Landcom 2009b). Industry developed tools are targeted primarily at ex-ante assessment, structured to aid decision-making in project design and enable certification of developer intent. A major incentive for developers to engage with these voluntary tools is the recognition of achievement that they provide, often resulting in a 'green' branding, which aids in marketing to potential home purchasers. There is also increasing focus on the use of sustainability assessment tools to inform, and potentially fast-track, development approvals. The UDIA, for example, declares that its "long term vision for EnviroDevelopment includes

negotiation with councils to provide incentives for certified projects, including rebates and fast-tracking development applications" (UDIA 2009b). This trend is also seen in the United States, where the USGBC have released *A Local Government Guide to LEED for Neighborhood Development* (USGBC 2011a) to integrate the use of LEED-ND with local planning policy and process. The development and use of such tools also helps to demonstrate proactive industry engagement with the challenges posed by sustainability, thus improving the industry's self-regulation 'credentials' and mitigating pressure to increase government regulation in this space (McCarthy and Prudham 2004).

Given the role that sustainability assessment tools play in setting the agenda for the operationalisation of sustainability in MPEs, it is both instructive and important to consider the organisational context for the tools' development. The developer of EnviroDevelopment is UDIA, the peak body for development corporations in Australia. The central role of UDIA is to advocate in the best interests of its member organisations, which includes lobbying for a reduced regulatory burden on the urban development sector. Indeed, part of the declared motivation for EnviroDevelopment is to provide an interpretation of sustainability for the urban development industry that can be "implemented swiftly and not cause an excessive burden on industry, government or certifiers" as "such burdens, whether in paperwork, time delays or financial costs, would be significant disincentives and a cost to the broader economy" (Plant et al. 2006:309).

Similarly, VicUrban – as the Victorian government's land development agency – has the challenging dual role of achieving a financial return from development projects while leading industry in setting benchmarks for sustainability performance. There is an obvious conflict between these competing priorities, and manifestations of this conflict are evident in both the VicUrban Sustainability Charter and MPCT. The MPCT's stated purpose of defining "best practice" sustainable development of MPE delivery in "common language" terms suggests an effort to set the agenda for the interpretation of sustainability in an urban development context in a way that best suits VicUrban. As outlined previously, the influence of VicUrban's business and organisational priorities are clearly evident in the objectives and priorities of the tool.

MPCT and EnviroDevelopment were both created via a process of committee-based decision-making, with input from a variety of sources, including stakeholders from industry and government, and various 'experts' and interest groups. The integrity of such tools therefore relies on the structure and membership of that committee; the integrity of information used to make decisions; the decision-making processes involved; and the nature and extent of consultation processes used to inform and engage stakeholders. For both the MPCT and EnviroDevelopment, this critical information is not provided, and the processes and justification for decision-making are not clearly discernable. While both tools have offered updates, the motivation for change is not explained, nor are the changes themselves explicitly communicated. As revealed in Chapter 6, in the process of developing the MPCT from the VicUrban Sustainability Charter, the changes made often constitute a significant weakening of requirements. This weakening undermines claims that the primary motivation for the tool is more sustainable development.

When sustainability assessment is considered within the context of development approval, there is further potential for conflicts of interest to arise in the use of these developer-led tools. Developers, understandably, have a vested interest in minimising cost implications in development delivery and, as such, have a preference for maintaining existing and established means of delivering development. This interest in maintaining inertia is rarely compatible with processes designed to institute change. Such conflicts of interest suggest that other drivers, such as the acceptability of measures to industry stakeholders, may be having a stronger influence on tool criteria, and therefore on assessment outcomes, than are sustainability principles. This highlights the need for independence in assessment processes (Standards Australia 2005; Roberts 2006). Without independent control of assessment or, at the very least, independent verification of assessment tools, existing industry-led assessment tools cannot be assumed to provide rigorous sustainability assessment.

Given their organisational mandates, both UDIA and VicUrban would be expected to respond first and foremost to market pressures, and this is likely to be reflected in their

tools. Tools like LEED-ND and EFA, on the other hand, which are developed and managed by independent non-profit organisations, have an advantage over industry–developed tools in that the propensity for the profit maximising agenda to affect the focus and mechanics of the tool is largely eliminated. Independent tools offer similar incentives to developers as industry-developed tools: a 'green' brand; and potential favour with planning approval authorities. However, their independence from industry provides some separation from vested industry interests. In the cases examined here, they provide a more transparent and rigorous methodology, and are therefore less susceptible to skewed interpretation. The tools still focus on ex-ante assessment, as the voluntary nature of engagement means that developers are attracted to the use of the tools by the potential advantages in the marketing and planning approval stages of development.

LEED-ND was developed using a similar committee-based decision-making process to EnviroDevelopment and MPCT. In LEED-ND, however, this process was transparent and carefully documented, and included extensive open consultation. The process of revision is also fully documented, with revised standards accompanied by itemised changes and explanations for the reasons behind the changes. The criteria that make up the tool are accompanied by an explanation of intent, and have clear and measurable targets, making it clear how compliance can be achieved. Further, a separate, independent institute has been set up to administer the certification process (GBCI 2009). While it is possible to challenge the criteria used in LEED-ND on practical, theoretical and conceptual grounds, the justification for their existence is made available, and the committee members responsible for determining them are known and contactable. The greater clarity in the tool's criteria improves consistency and repeatability in assessment, increasing the likelihood that two different assessors of the one development achieve the same result.

Quite apart from the relevant merits of the content and methodology of these tools, a significant factor determining their influence is their voluntary nature. All the tools examined in Chapter 6 are voluntary, requiring that developers proactively choose to engage with sustainability assessment. The difficult challenge for voluntary tools is to

be attractive to developers by making certification both achievable and marketable, whilst still being able to deliver meaningful improvement in practice (Retzlaff 2009).

Voluntary mechanisms naturally attract developers who can see economic benefit in their use – generally those who have decided that part of their portfolio will target the higher end, 'green-consumer' sector of the market. Engagement is thus part of a strategy to differentiate their product. The risk, therefore, is that tools are only used by the already high-achieving 'boutique' developers, which significantly limits their potential impact on broader development practice. Developers also tend to carefully select which of their projects should seek certification, so even within that small subsection of developers that see the market benefit of engaging with such tools, it is likely that only a small proportion of their projects will seek and achieve certification. As there is no requirement to apply the assessment tools across a developer's portfolio of projects, they can selectively apply the tools to projects (or development stages/phases) that are designated to target the 'green-consumer'. Thus, a developer can receive 'green' certification based on a small portion of their overall housing stock, regardless of whether the majority of their stock meets only standard (or even minimum) practice.

This raises the question of whether voluntary approaches can play a significant role in changing industry practice. The utility of voluntary tools is based on the notion that they facilitate improvements in best practice, capitalising on industry innovation via flexible performance-based assessment, which in turn paves the way for improved industry practice, and eventually the raising of minimum standards. The investigation of tools documented here raises serious concerns about the validity of such an argument.

In the case of each of the criteria-based tools examined, there is little clear engagement with the conceptual foundations of sustainability. Rather, sustainability is defined, either deliberately or by default, via the design of their assessment frameworks, the criteria that make up these frameworks, and the means of measuring and prioritising actions to satisfy criteria. The issues covered in the tools broadly align with the issues of sustainable urbanism evident in the literature. However, the emphasis placed on

particular issues varies significantly between tools, with little attempt to justify the nature of the issue focus in terms of delivering on sustainability principles; and in the case of EnviroDevelopment and MPCT, little attempt to justify the issue focus in any terms. In addition, the significance of the requirements of each criterion is often unclear, with no attempt made to explain requirements in the context of end goals.

It is evident that voluntary tools ultimately present limited opportunity to impact on the sustainability of MPE developments. They are limited to engagement with a small selection of developers who selectively apply assessment to targeted projects for which they seek 'green' credentials. Further, there is a strong presence of industry-developed sustainability assessment tools with limited rigour and transparency. Such tools appear to be targeted at identifying and championing better examples of existing development, rather than assessing developments against requirements for sustainable urbanism. The end result is sustainability assessment tools based on the achievements of existing 'green' developments, being used to assess other potential 'green' developments. Their content, mechanics, application, and evaluation is neither transparent nor subject to independent oversight. At best these tools can be considered as gradually laying the foundations for more significant change. However, as mechanisms that define sustainability in developers' own terms, and celebrate the achievements of a limited number of leading developments with marginal improvement upon existing standard practice, they distract and divert attention from the need for rigorous sustainability assessment approaches that lift performance across the sector, and thus divert scrutiny of current developer practice.

Chapter 8: Conclusion

In this thesis I have presented a critical examination of attempts to operationalise sustainability in MPE development through an analysis of sustainability assessment tools acting in this space. It revealed a limited, but growing interest in the sustainability of MPE development, and a corresponding emergence of sustainability assessment tools targeted at this scale of development. However, existing tools are limited in number and diverse in approach, with little critical interrogation of their integrity and effectiveness. It is this gap in critical attention to which this thesis contributes.

The catalyst for the investigation was VicUrban's Aurora development and the creation of the VicUrban Sustainability Charter, developed to assess sustainability in new MPE developments. Aurora was launched in 2006 as VicUrban's new flagship in sustainable development (VicUrban 2007). The Sustainability Charter (later MPCT) aimed to assess the sustainability of proposed MPEs, and in doing so enable improvements to be made in existing development practice. Five years on, Aurora now has 1,500 of its planned 25,000 residents. In terms of environmental performance, it is a cut above the other urban fringe estates that surround it – its showcase initiatives, such as the 6-star energy rated homes and third-pipe water recycling system, have been delivered. However, as the local newspaper recently reported, public transport and service provision is next to non-existent, with residents dependent on car travel to access basic services, resulting in growing discontent amongst those home buyers who were influenced by the promise of local services and quality transport infrastructure (Weymes 2011).

Since the launch of Aurora there has been increased activity in the sustainability assessment of MPEs in Australia, with the addition of EnviroDevelopment from the UDIA; several EFA studies of MPEs, including one of Aurora; and increasing interest in international tools such as LEED-ND. It is these tools, along with the VicUrban developed tools that make up the case studies examined in this research. In the last 18 months, a number of other sustainability tools have been launched targeting the MPE scale of development in Australia, demonstrating the continued growth in interest and

activity. The GBCA launched a framework of guiding principles for its Green Star Communities rating tool in 2010, which will in part build on the work of VicUrban and Sustainable Community Rating; although the tool itself remains under development (GBCA 2011). Landcom, the NSW government development agency (equivalent to Victoria's VicUrban) launched its PRECINX tool in late 2009 (Landcom 2009b), though to date there is limited publicly available information on its functionality and use. HASSELL, a consultancy company, is developing a proprietary tool called LESS – Local area Envisioning and Sustainability Scoring (Varshney et al. 2009). Internationally, the release of BREEAM Communities in 2009 (BRE Global 2009) and Beacon Neighbourhood Sustainability Framework in 2010 (Beacon 2010) are of interest, since both tools focus on a scale of development appropriate to MPEs. While these tools have fallen outside the scope of detailed interrogation in this research, they present opportunities for further research attention.

At the outset, I outlined the research questions driving this inquiry. The research has sought to determine how sustainability assessment tools can help to effectively implement sustainability principles in the delivery of MPEs in Australia. In doing so, four sub questions were proposed and can now be answered:

1. What is the relevance of sustainability and sustainability assessment theory in the delivery of MPEs?
2. What constitutes effectiveness in sustainability assessment of MPEs?
3. How effective are existing sustainability assessment tools in operationalising sustainability principles in the delivery of MPEs in Australia?
4. How can sustainability assessment be more effectively used to operationalise sustainability principles in the delivery of MPEs in Australia?

The relevance of sustainability in the delivery of MPEs

The MPE is increasingly prevalent as the common 'unit' of urban growth in Australia. As such they have a significant impact on the sustainability of cities, through their own form and function; their connection and integration (or otherwise) to the existing city; and their consumption of urban fringe land. The sustainability of human existence is wedded to the performance of cities, and it is thus critical to consider MPEs, as the

emerging dominant form of development on the fringe of cities, through the lens of sustainability.

The breadth and diversity of attempts to engage with sustainability has resulted in considerable variability in the integrity of the use of its principles, and much debate and contention as to the usefulness of sustainability as a theoretical foundation for development. It is therefore critical that any attempts to assess sustainability in MPE development is based on a meaningful and transparent engagement with sustainability principles. I have argued that fundamental to this engagement are the principles of inter-generational and intra-generational equity. Building on these fundamental principles and evidence from literature, I have presented objectives for sustainable urbanism in the context of MPE development (Table 2). Furthermore I have argued that a systems approach, with its articulation of the dependence of socio-economic outcomes on a viable and sustained ecosystem, provides a strong theoretical foundation for engagement with sustainability.

Framing effectiveness in sustainability assessment of MPEs

This research has paid particular attention to determining what constitutes effectiveness in sustainability assessment. The result of this was the analytical framework presented in Chapter 5 which was used to interrogate the case studies in Chapter 6. The framework was derived from a critical review of literature on sustainability, sustainability assessment and MPEs. By identifying the key characteristics of effective sustainability assessment of MPEs – and of urban development more broadly – the framework constitutes a significant contribution resulting from this research. It provides detailed principles that need to be observed for effectiveness and integrity, rather than prescribing a single 'correct' approach to sustainability assessment of MPEs, leaving room for different methodologies and processes. It thus constitutes a clear and rigorous mechanism for evaluating sustainability assessment tools.

The framework also provides a valuable conceptual basis for the modification of existing tools, or the development of new tools. It has been applied to four case studies in this thesis, but there is potential for it to be used in further research, for application to

new and emerging tools. There is also scope to consider its use in evaluating sustainability assessment tools at other scales of urban development, and more broadly in the operationalisation of sustainability in human development. In particular, it has the potential to inform a stronger role for planning policy in operationalising sustainability in MPEs, providing a basis for the development of accreditation standards for third-party assessment tools, or the basis for the development of purpose-built sustainability assessment for use in the planning approval process.

Effectiveness of existing tools

The research has used case study methodology, based on structured, focused comparison of cases of intrinsic interest, to investigate the operationalisation of sustainability though sustainability assessment in MPEs. The aim was to examine sustainability assessment tools and procedures to establish the effectiveness of different approaches in terms of sustainability and assessment principles. Four cases were examined, representative of both industry-developed and independent tools, and of criteria-based assessment and quantitative systems-based methodology.

In the case study analysis, the industry-developed tools are represented by MPCT and EnviroDevelopment. These tools have the ability to engage the development sector by simplifying complex issues such that they can be integrated into the development delivery process. They facilitate incremental change, presenting lists of achievable actions in their assessment frameworks for a developer to consider for implementation. However, the tools are not clearly derivative of sustainability principles, and can be open to prioritising the economic bottom line at the expense of better environmental and social outcomes. The frameworks tend to favour increased flexibility in assessment, based on the argument that flexibility aids innovation. The result is an avoidance of the more complex and difficult challenges posed by sustainability for MPEs, with little challenge to 'business as usual' development. In their development and application the tools lack transparency and accountability. They also tend to focus on the internal workings of development, rather than the development's impact on urban form and function.

It is evident that tools developed by actors independent of industry concerns provide more transparent and rigorous sustainability assessment. Of the case studies examined, the two independent tools, LEED-ND and EFA, are significantly more open in their methodology and means of application, and rigorous in their means of assessment. However, as voluntary tools, they are ultimately limited in their ability to engage the development sector. They either need to be enticing enough to attract a significant proportion of developers, and therefore limited in the extent to which they can prescribe significant change; or alternatively settle for engaging only the most proactive, socially and environmentally conscious developers.

The dominant assessment methodology used in tools targeted at operationalising sustainability in MPEs is criteria-based assessment. In the case studies examined, those using criteria-based assessment (MPCT, EnviroDevelopment, and LEED-ND) diverge significantly in their coverage of issues, with little clear justification of issue coverage based on sustainability principles and objectives. Further, the assessment mechanisms for attributing value to issues in MPCT and EnviroDevelopment do not have a clear principles and objectives basis, nor do they necessarily align with the potential to improve on sustainability performance. If issues are not prioritised according to their ability to contribute to more sustainable outcomes, the question needs to be asked as to what is motivating the attribution of value. Not aligning with sustainability impact is a weakness; having no clear logic or justification as to the reasons behind attributing value is a more serious failing.

The criteria-based tools offer the potential for incremental improvement upon current practice, but little ability to indicate the significance of change that is being delivered against target goals for sustainable urban development. This is in contrast to EFA, which is based on a systems approach to assessment, and attempts to quantify the ecological demand of development and puts this within the context of ecological capacity. Its key strength, therefore, is its ability to provide a rigorous assessment of a proposed development in comparison to both current practice and the end goal of sustainable urban development, clearly communicating the significance of change. However, EFA involves a complex assessment methodology requiring extensive

assumptions, limiting its practicality for use in assessment of MPE development. It also does not explicitly target the MPE scale of development, or even urban development more broadly, and thus the scope of assessment does not integrate with the typical decisions and challenges that face the delivery of MPEs.

It is evident that there is a diversity of approaches to sustainability assessment, both in terms of interpretation of sustainability, and how this is operationalised, resulting in outcomes with varying degrees of significance. The cases examined here can be viewed as important steps in an ongoing process of change. As voluntary industry-developed and independent assessment tools, they can play a role in developing capacity within industry; facilitating examples of 'best-practice' urban development, which in turn influence other developers and the development market. They also have potential to improve understanding of sustainability in the housing marketplace, with the potential flow-on effect of increasing consumer demand for 'green' credentials. Such voluntary frameworks could, in time, become the basis for formal inclusion of sustainability assessment in planning policy, or even for the implementation of mandatory sustainability assessment. However, as highlighted by this research, there is little evidence in practice that developments engaging with voluntary tools are making much progress. At the very least, the claims of such tools must be compared against monitored performance of the resulting built form, to ensure that the promised change does eventuate, and that the tools do contribute to significant and realised improvement in urban development. With sustainability principles clearly pointing to the need for significant and transformative change in urban fringe development, the risk is that such assessment tools, if accepted without critical attention, will fall well short of producing the end outcomes we should expect of something labelled as 'sustainable'. As Dovers (2007:33) argues, while sustainability principles are these days "universally endorsed", in practice they are at best "underachieved". We risk accepting a situation where an assortment of frameworks, with little accountability, are selectively applied by only a few developers to only a few high-end developments. In this scenario, assessment tools become simply green-marketing tools for the small proportion of developers that are responding to the 'green-consumer' market sector. Such an outcome could be fairly criticised as doing little more than dressing up the status quo as sustainable

development, diverting and distracting attention from the more substantial transformation required; and deferring the development and implementation of more effective assessment, governance and policy frameworks.

Improving outcomes via sustainability assessment

In examining the operationalisation of sustainability in MPEs via sustainability assessment, this research aims to make a contribution to improved sustainability performance of urban development. As such, a significant contribution emerging from the research are findings regarding the extent and nature of change required in the mechanics of tools and in the processes of sustainability assessment of MPEs. It is clear from the research that there are significant deficiencies in existing assessment tools, and much scope for improvement in their use.

To deliver rigorous and meaningful sustainability assessment tools the starting point must be a transparent and robust engagement with sustainability principles, specifically the principles of inter-generational and intra-generational equity and what these mean for urban development. The systems-based urban metabolism approach provides a rigorous theoretical framing for this. The analytical framework developed in this research outlines five characteristics that are critical for effective sustainability assessment of MPEs: openness allows for accountability and validity; merit and worth ensure a clear and meaningful engagement with the needs of sustainability in the context of MPEs; and rigour and practicality provide for assessment that is transparent and repeatable, as well as being appropriate to its context. It is also argued that effective assessment for operationalising sustainability in MPEs needs an integrated approach encompassing ex-ante and ex-post assessment. Ex-ante assessment provides design decision support and accreditation of development proposals to aid financing, planning approval, and sales; and facilitates incremental change. Ex-post assessment provides critical evaluation of the outcomes of a project, allowing validation and continual calibration and improvement of ex ante assessment. Baseline performance must be clearly established, with target goals set; such that assessment of projects can be compared with both existing practice and end goals, thus allowing determination of the significance of a proposed project's contribution to sustainability. In combination,

these measures could provide meaningful sustainability assessment of MPEs, and better facilitate the delivery of sustainable MPEs.

It is also evident that existing processes for implementing sustainability assessment have limited scope to effect meaningful change, and that further change is needed in the development delivery process and broader policy setting. Sustainability assessment in the existing development delivery context is characterised by market led approaches with minimum government intervention, and assessment tools that operate in isolation from the planning approval process. From the developer perspective, this reduces the attractiveness of engaging with sustainability assessment, as there is little benefit from a planning approvals point of view. It also means that claims to sustainability in MPE development are being made with little external scrutiny, and no scrutiny from those in charge of strategic planning in cities – state and local governments. As such, there is no evaluation of whether the sustainability claims of industry match the sustainability goals of strategic planning. Beuschel and Rudel (2010) highlight this lack of critical attention of claims to "greenness" in a North American urban development context, noting that there is an increasing propensity for developers to use "green rhetoric" in order to maintain beneficial relationships with local planning authorities (2010:99). As the authors suggest, "viewed from a macro-environmental perspective, [these] green developer practices … might be considered 'embroidering around the edges' of environmentally destructive greenfields development" (2010:107).

The existing situation allows non-government actors, and industry in particular, to set the agenda on the interpretation of sustainability in urban development. It would seem that given increasing public awareness and interest in 'sustainable' and 'green' credentials in the urban development sector, industry actors see proactive engagement with sustainability as preferable to the imposition of sustainability mechanisms from outside interest groups or government policy. Limited government intervention, and the strong push for industry 'self regulation', is reflective of a broader neoliberalist governance approach that has dominated planning policy in recent times (Gleeson and Low 2000; Mees 2003). The end result is voluntary, market-based sustainability assessment tools that neither demand significant improvement in current practice, nor

have any significant impact on the MPE market, other than a small, niche component. Further, there is increasing pressure for these tools to enable fast-tracked planning processes or other planning concessions (UDIA 2009b; Beuschel and Rudel 2010).

It is clear that there is a willingness for industry to engage in sustainability assessment of MPEs, but with mixed outcomes and evidence of market motivations directing this engagement. This points to a role for government intervention to provide quality assurance in the operationalisation of sustainability in MPE development. Indeed the conflict between economic imperatives and sustainability objectives leads many to argue that achieving urban sustainability objectives requires market intervention, as discussed in Chapter 2 (Low 2008; Perez-Arriaga and Linares 2008; van Dijk 2009; Adams and Tiesdell 2010). Others, such as McGuirk (2005) and Healey (1998) highlight the potential for increased roles for public policy in the determination and classification of sustainability in urban development, without arguing for a radical move to regulation. McGuirk (2005) indicates the potential to achieve social goals not catered to by market forces with the use of 'after-neoliberal' hybrid approaches, based on partial deregulation and market mechanisms, but with a substantial role for state agencies. While supporting the position that state mechanisms should facilitate development to ensure continued investment in urban areas, Healey (1998) asserts the importance of such mechanisms to ensure investment addresses public purpose objectives, and further argues that there is a role for government to facilitate capacity and change in the development sector.

While there has been little engagement from government in sustainability assessment of MPEs to date, there is significant potential, and arguably also a significant need, for them to do so though the planning approval process. Strategic planning objectives such as urban consolidation, public transport optimisation, and well-serviced connected communities, are not particularly well-served by industry sustainability assessment tools that demonstrate a strong focus on the internal workings of MPEs rather than the role of MPEs in the boarder urban form. A critical function of the planning approval process is to ensure that potential developments are integrated with the strategic needs of the regions within which they will exist. It is important, therefore, to carefully consider the

scope of tools acting in this space. Tools that define the sustainability of MPEs via criteria that only have an internal focus could quite likely be in conflict with strategic urban planning, such as policies that seek to limit urban expansion, or integrate development with public transport – policies which would also claim to be based on sustainable urbanism principles. Therefore, while an assessment tool may accredit a given development as 'sustainable', they could in fact be wholly unsustainable in the context of the surrounding city. Further, as Retzlaff (2008; 2009) argues, building regulations provide too narrow a scope to have significant impact on the sustainability of urban development. She makes the case for the role of planners and planning regulation in providing an integrated response to the challenges of sustainable urbanism, in particular highlighting the role of local government as being best placed to implement policies for sustainable urbanism due to its holistic view of the needs of local communities and connection with local circumstances.

There are four possible scenarios for government engagement with sustainability assessment of MPE development. The first is the 'do nothing' approach, by simply maintaining the current status quo. I have argued throughout this chapter, that this is an undesirable outcome, as current engagement with sustainability assessment is having minimal impact on MPE development and is allowing the sustainability agenda to be defined in industry terms to suit their profit-generating purpose. The second option is to respond to the calls for planning policy recognition of existing assessment tools. In such a scenario, local government (or the relevant approval authority) would provide incentives for developers to use tools, either by fast tracking applications or through concessions against specified planning controls. This would offer significant inducement for developers to engage with sustainability assessment, increasing the reach, and therefore impact, of existing tools. However, this does not address significant concerns regarding the ability of existing tools to deliver meaningful engagement with sustainability, or deliver on strategic planning outcomes. Given the great diversity observed amongst tools in terms of issue coverage and prioritisation, it also raises the question of which tools should be 'approved' for gaining concessions in planning approval, and how such an approval process would work. This scenario offers some potential to improve on existing sustainability outcomes, but is very much

dependent on the quality of existing tools and their degree of use. Without adequate scrutiny, it also has the potential to worsen the situation by legitimising inadequate sustainability assessment tools.

The third scenario sees a more significant engagement by government with existing sustainability assessment tools, with the planning approval process acknowledging market-based tools, in combination with standards or benchmarks to which such tools would be held accountable, and a clear process for the incorporation of tools into the planning approval process. This scenario keeps the development and implementation of sustainability assessment out of government hands, allowing for a degree of industry and independent leadership and innovation in operationalising sustainability in MPEs, while providing the benefits to developers of concessions in the planning approval process. To maintain a level of rigour in the use of non-government tools, state government as the planning approval authority would need to develop standards to ensure that only tools that demonstrate rigorous, transparent, and verifiable assessment and the ability to deliver measurable sustainability outcomes, would be endorsed. In addition, state government would need to develop guidelines or policy for the integration of approved tools in the planning approval process. Local government, as the delegated authority for planning approval, could then integrate sustainability assessment into their planning approval processes with confidence.

In this scenario, the use of sustainability assessment tools remains voluntary, and so the limitations of voluntary assessment discussed above would remain. However, government oversight and approval would likely increase industry confidence in assessment tools, and there would be significant potential for state and local government to further incentivise the use of tools, as well as proactively working with industry to help build capacity in sustainability assessment and increased ability to deliver the built form outcomes required of more sustainable development.

The fourth scenario sees government take the lead in developing sustainability assessment mechanisms and integrating these with the planning approval process, requiring all developers to engage at some level and rewarding those that excel.

Centralising assessment provides for commonality and consistency in assessment (Roberts 2006). In this scenario, state government would develop sustainability assessment mechanisms and integrate these into the planning approval processes, thus allowing policy makers to set the agenda for sustainability in urban development. Engagement with the tools could be voluntary, with incentives in the planning approval process as inducement, or compulsory. Compulsory engagement would allow the government to set minimum standards for development, through the use of sustainability assessment, as well as offer incentives to advance the leading edge of development practice. This scenario offers the greatest potential to mandate and achieve environmental and social sustainability goals in MPE development.

It is incumbent upon public authorities with the jurisdiction over both the strategic development and growth of cities and the planning and development approval of MPEs, to engage with the lack of sustainability in existing development. Such authorities should ensure that efforts to operationalise sustainability in MPEs are based on a meaningful engagement with sustainability and a rigorous methodology for facilitating action. This research demonstrates that existing industry-developed tools lack rigour, transparency and significance of outcomes; and are designed with the interests of commercial developers at the forefront. They are therefore a poor match with the sustainability objectives of strategic urban planning policy. The research also shows that existing independent tools fail to meet the scope and practicality needs of sustainability assessment of MPEs in an Australian context, and provides a thorough determination of critical characteristics of sustainability assessment in this context. For effective and meaningful sustainability assessment of MPE development it is thus incumbent upon government to either develop standards to ensure the integrity of industry and independent tools or to develop its own mechanisms for sustainability assessment; and to ensure that these responses are effectively integrated into the planning approval process. Such action is required to ensure that the concept of sustainability is not abused and diffused to the point where it is meaningless; and that the fundamental sustainability principles of improving equity and well-being while sustaining ecological systems and services are incorporated into the delivery of MPEs.

Agenda for future research

This research has revealed a growing engagement with sustainability rhetoric in the MPE development sector; and evidence of changed practices in an effort to operationalise sustainability principles. In particular, the creation and use of sustainability assessment mechanisms at the precinct scale is increasingly evident. However, it is also apparent that this engagement with sustainability principles lacks rigour and transparency. In critically examining contemporary sustainability assessment tools, the research findings have also revealed gaps in knowledge where further research, is required, including:

- The application of the analytical framework developed in this research to critical evaluations of relevant tools in development or planned, including Green Star Communities;
- The extension of the analytical framework developed in this research, along with the findings on existing tools, into a broader system of more rigorous and effective sustainability assessment mechanisms;
- The further expansion and application of the analytical framework developed in this research to sustainability assessment approaches at other scales (building scale, and broader urban/regional scales) and urban development contexts;
- A study of trends and future prospects for MPE and other development types in Australia and/or internationally, in order to inform sustainability assessment researchers, practitioners and policy makers on where future demand for improved sustainability assessment tools is likely to occur;
- Studies of the institutional structure, capacity and dynamics of the urban development sector, in order to inform the public policy options for enabling the sector to more effectively implement sustainability principles in greenfield development.

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